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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer.*

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For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 937
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 940
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 941
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 941
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 943
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 943
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION N.A.
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 943
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 944
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 945
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 946
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 947
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

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Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL N.A.

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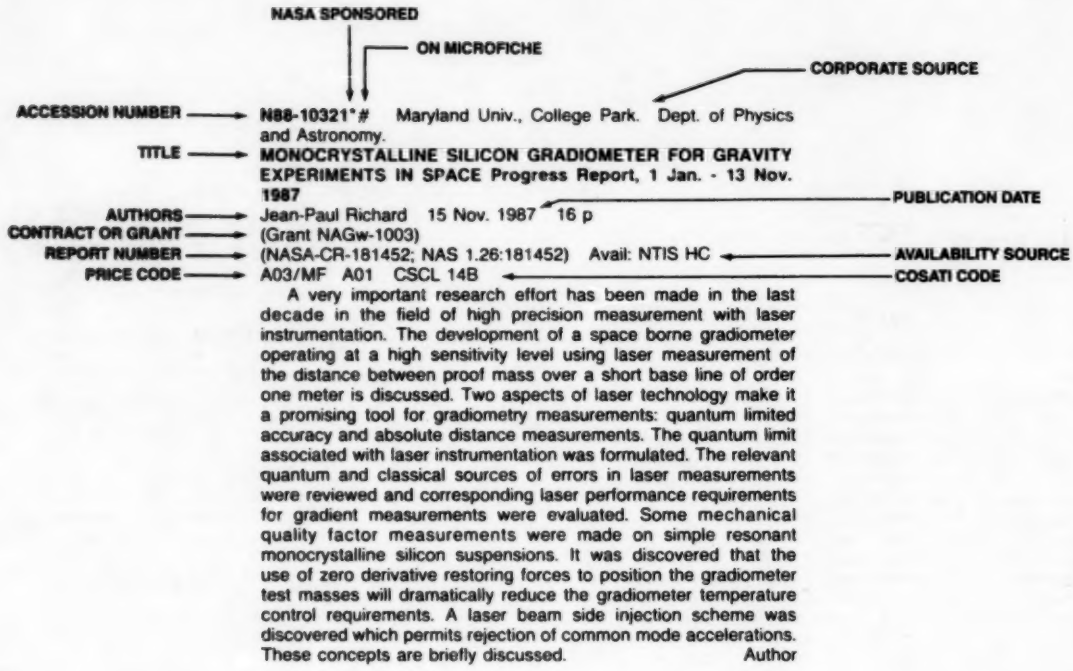
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COSATI CODE
A very important research effort has been made in the last decade in the field of high precision measurement with laser instrumentation. The development of a space borne gradiometer operating at a high sensitivity level using laser measurement of the distance between proof mass over a short base line of order one meter is discussed. Two aspects of laser technology make it a promising tool for gradiometry measurements: quantum limited accuracy and absolute distance measurements. The quantum limit associated with laser instrumentation was formulated. The relevant quantum and classical sources of errors in laser measurements were reviewed and corresponding laser performance requirements for gradient measurements were evaluated. Some mechanical quality factor measurements were made on simple resonant monocrystalline silicon suspensions. It was discovered that the use of zero derivative restoring forces to position the gradiometer test masses will dramatically reduce the gradiometer temperature control requirements. A laser beam side injection scheme was discovered which permits rejection of common mode accelerations. These concepts are briefly discussed. Author

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N88-14924# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A PROTOTYPE H-46 HELICOPTER DIAGNOSTIC EXPERT SYSTEM M.S. Thesis
Thomas J. Gadzala Sep. 1987 125 p
(AD-A186077) Avail: NTIS HC A06/MF A01 CSCL 01C

This study was undertaken to demonstrate the feasibility of applying expert system technology to the Navy's H-46 helicopter maintenance process. A microcomputer based prototype known as a computer-aided diagnostic system (CADS) was developed for this purpose. Given a helicopter electrical or hydraulic system discrepancy, the troubleshooter interacts with CADS to find the cause. The prototype CADS was developed utilizing the M.1 knowledge-based system development tool by knowledge, Inc. The complexity of helicopter systems diagnosis, and inadequacies of the maintenance manuals, often result in unnecessary removal of system components. The prototype CADS is intended to demonstrate that a fully developed system, containing all the formal and heuristic knowledge of H-46 diagnostic information, could eliminate these problems. Also, such a diagnostic system could provide a comprehensive, stable diagnostic knowledge base, regardless of personnel turnover. This study includes a description of current helicopter maintenance procedures and how the integration of CADS could improve this process. Also included are descriptions of expert systems and the M.1 knowledge-based system development tool; how they work, and their applicability to structured selection problem-solving. The development and testing strategies used for CADS are discussed in detail. Results, conclusions, and recommendations for further study are provided. GRA

N88-14925# Netherlands Agency for Aerospace Programs, Delft.
[ACTIVITIES REPORT IN AIRCRAFT DESIGN AND ASTRONAUTICS] Annual Report, 1985 [VERSLAG VAN DE WERKZAAMHEDEN 1985]
1985 35 p In DUTCH
(ETN-88-90618) Avail: NTIS HC A03/MF A01

Contributions to the design of the F28, Fokker 50, Fokker 100, Airbus, Shorts SD 330/360 aircraft, and to the development of measuring, registration, and processing systems and aircraft technology are outlined. Activities in aerospace technology programs, solar panels, and ESA progams (telecommunication, Earth observation, Meteosat, rocket vehicle development, Spacelab, EURECA, microgravity, Columbus) are described. ESA

N88-14926*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY SYMPOSIUM ON AERODYNAMICS, VOLUME 1
Sharon H. Stack, comp. Dec. 1986 592 p Symposium held in Hampton, Va., 23-25 Apr. 1985
(NASA-CP-2397; L-16031; NAS 1.55:2397) Avail: NTIS HC A25/MF A01 CSCL 01B

The purpose of this work was to present current work and results of the Langley Aeronautics Directorate covering the areas of computational fluid dynamics, viscous flows, airfoil aerodynamics, propulsion integration, test techniques, and low-speed, high-speed, and transonic aerodynamics. The following sessions are included in this volume: theoretical aerodynamics, test techniques, fluid physics, and viscous drag reduction. For individual titles, see N88-14927 through N88-14956.

N88-14927*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL FLUID DYNAMICS OVERVIEW **c34**
Percy J. Bobbitt *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 5-24 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

The hierarchy of codes; boundary layers and turbulence models; uniqueness and artificial viscosity; efficiency of solution algorithms; data display and analysis; and cost of experimental validation are briefly examined. B.G.

N88-14928*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FINITE-VOLUME SCHEME FOR TRANSONIC POTENTIAL FLOW ABOUT AIRFOILS AND BODIES IN AN ARBITRARILY SHAPED CHANNEL **c02**
Jerry C. South, Jr., Michael L. Doria (Valparaiso Univ., Ind.), and Lawrence L. Green *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 25-43 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

A conservative finite-volume difference scheme is developed for the potential equation to solve transonic flow about airfoils and bodies in an arbitrarily shaped channel. The scheme employs a mesh which is a nearly conformal O mesh about the airfoil and nearly orthogonal at the channel walls. The mesh extends to infinity upstream and downstream, where the mapping is singular. Special procedures are required to treat the singularities at infinity, including computation of the metrics near those points. Channels with exit areas different from inlet areas are solved; a body with a sting mount is an example of such a case. Author

N88-14929*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BREAKDOWN OF THE CONSERVATIVE POTENTIAL EQUATION **c02**
M. D. Salas and C. R. Gumbert *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 45-71 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

The breakdown of the conservative potential approximation occurs for all the airfoils tested. It develops as soon as the shock waves appear in the flow field. Since shock waves are not properly represented by the potential approximation, it is conjectured that the breakdown is due to the isentropic shock jump condition of the potential approximation. Author

N88-14930*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF A FULL POTENTIAL METHOD FOR ANALYSIS OF COMPLEX AIRCRAFT GEOMETRIES **c05**
Kenneth M. Jones and Noel A. Talcott, Jr. *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 73-87 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

A supersonic potential flow solver was developed to analyze the flow over complex realistic aircraft geometries. Enhancements to the method were made to accommodate regions of subsonic flow, the effect of trailing wakes on other aircraft components, and the modeling/gridding of complete configurations. Validation of the method was demonstrated by comparisons with experimental aerodynamic force and surface pressure measurements. The predicted results are in very good agreement with the experimental data. The bibliography contains additional information on the use of the potential flow code to predict the aerodynamics of high-speed wing/body configurations, waverider concepts, TAV, and the Space Shuttle orbiter package. Author

N88-14931*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
UPWIND RELAXATION ALGORITHMS FOR EULER/NAVIER-STOKES EQUATIONS **c02**
J. L. Thomas, R. W. Walters, D. H. Rudy, and R. C. Swanson *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 89-107 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

A description of and results from a solution algorithm for the compressible Navier-Stokes equations are presented. The main features of the algorithm are second or third order accurate upwind discretization of the convection and pressure derivatives and a relaxation scheme for the unfactored implicit backward Euler time method, implemented in a finite-volume formulation. Upwind methods were successfully used to obtain solutions to the Euler equations for flows with strong shock waves. The particular upwind method being used is based on the flux vector splitting technique developed by Van Leer and both second and third order accurate discretizations were developed. Currently, the most widely used implicit solution technique for the Navier-Stokes equations use approximate factorization (AF) methods to treat multidimensional problems. The time integration scheme being used in the present algorithm corresponds to a line Gauss-Seidel relaxation method. This method produces good convergence rates for steady-state flows, and most of the algorithm was vectorized on the NASA Langley VPS 32 computer. The Navier-Stokes algorithm was tested for several two-dimensional flow problems. Solutions for the problems gave excellent results. The presented effort is directed toward the extension of the scheme to the full three-dimensional Navier-Stokes equations. Author

N88-14932*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A MULTISTAGE TIME-STEPPING SCHEME FOR THE THIN-LAYER NAVIER-STOKES EQUATIONS **c02**
R. C. Swanson, Jr., Eli Turkel (Tel-Aviv Univ., Israel), and V. N. Vatsa *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 109-135 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

A finite-volume scheme for numerical integration of the Euler equations was extended to allow solution of the thin-layer Navier-Stokes equations in two and three dimensions. The extended algorithm, which is based on a class of four-stage Runge-Kutta time-stepping schemes, was made numerically efficient through the following convergence acceleration technique: (1) local time stepping, (2) enthalpy damping, and (3) residual smoothing. Also, the high degree of vectorization possible with the algorithm has yielded an efficient program for vector processors. The scheme was evaluated by solving laminar and turbulent flows. Numerical results have compared well with either theoretical or other numerical solutions and/or experimental data. Author

N88-14933*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUMERICAL SIMULATION OF A CONTROLLED BOUNDARY LAYER **c34**
Thomas A. Zang and M. Yousuff Hussaini *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 137-152 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

The problem of interest is the boundary layer over a flat plate. The three standard laminar flow control (LFC) techniques are pressure gradient, suction, and heating. The parameters used to describe the amount of control in the context of the boundary layer equations are introduced. The numerical method required to find the mean flow, the linear eigenvalues of the Orr-Sommerfeld equation, and the full, nonlinear, 3-D solution of the Navier-Stokes equations are outlined. A secondary instability exists for the parallel boundary subject to uniform pressure gradient, suction, or heating. Selective control of the spanwise mode reduces the secondary instability in the parallel boundary layer at low Reynolds number. B.G.

N88-14934*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VISCOUS VORTEX FLOWS **c02**
R. P. Weston, J. P. Chamberlain, C. H. Liu, and Peter-Michael Hartwich *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 153-168 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

Several computational studies are currently being pursued that focus on various aspects of representing the entire lifetime of the viscous trailing vortex wakes generated by an aircraft. The formulation and subsequent near-wing development of the leading-edge vortices formed by a delta wing are being calculated at modest Reynolds numbers using a three-dimensional, time-dependent Navier-Stokes code. Another computational code was developed to focus on the roll-up, trajectory, and mutual interaction of trailing vortices further downstream from the wing using a two-dimensional, time-dependent, Navier-Stokes algorithm. To investigate the effect of a cross-wind ground shear flow on the drift and decay of the far-field trailing vortices, a code was developed that employs Euler equations along with matched asymptotic solutions for the decaying vortex filaments. And finally, to simulate the conditions far down stream after the onset of the Crow instability in the vortex wake, a full three-dimensional, time-dependent Navier-Stokes code was developed to study the behavior of interacting vortex rings. Author

N88-14935*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A THEORY FOR THE CORE FLOW OF LEADING-EDGE VORTICES **c02**
James M. Luckring *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 169-185 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

Separation-induced leading-edge vortices can dominate the flow about slender wings at moderate to high angles of attack, often with favorable aerodynamic effects. However, at the high angles of attack which are desirable for takeoff and landing as well as subsonic-transonic maneuver the vortices can breakdown or burst in the vicinity of the aircraft causing many adverse effects; these include lift loss, pitchup, and buffet. The flow in the core of leading-edge vortices is generally affiliated with the vortex breakdown phenomenon. A theory is presented for the flow in the core of separation-induced, leading-edge vortices at practical Reynolds numbers. The theory is based on matching inner and outer representations of the vortex. The inner representation models continuously distributed vorticity and includes an asymptotic viscous subcore. The outer representation models concentrated spiral sheets of vorticity and is fully three dimensional. A parameter is identified which closely tracks the vortex breakdown stability boundary for delta, arrow, and diamond wings. Author

N88-14936*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS AND PERFORMANCE PREDICTION OF SCRAMJET INLETS UTILIZING A THREE-DIMENSIONAL NAVIER-STOKES CODE **c07**
Ajay Kumar and Carl A. Trexler *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 187-208 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 21E

A series of inlet analysis codes (2-D, axisymmetric, 3-D) were developed which can analyze complicated flow through complex inlet geometries in a reasonably efficient manner. The codes were verified and are being used extensively to analyze practical inlet geometries both at Langley as well as industries. Newly installed VPS 32 computer will allow more complex configurations to be analyzed. Scalar FORTRAN versions are available to increase transportability of the codes for use on other Scalar computers and on the Cray vector processing computer. Author

N88-14937*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-DISTURBANCE WIND TUNNELS **c09**
I. E. Beckwith, Z. T. Applin, P. C. Stainback, and L. Maestrello *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 209-223 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

During the past years, there was an extensive program under way at the Langley Research Center to upgrade the flow quality in several of the large wind tunnels. This effort has resulted in significant improvements in flow quality in these tunnels and has also increased the understanding of how and where changes in existing and new wind tunnels are most likely to yield the desired improvements. As part of this ongoing program, flow disturbance levels and spectra were measured in several Langley tunnels before and after modifications were made to reduce acoustic and vorticity fluctuations. A brief description of these disturbance control features is given for the Low-Turbulence Pressure Tunnel, the 4 x 7 Meter Tunnel, and the 8 Foot Transonic Pressure Tunnel. To illustrate typical reductions in disturbance levels obtained in these tunnels, data from hot-wire or acoustic sensors are presented. A concept for a subsonic quiet tunnel designed to study boundary layer stability and transition is also presented. Techniques developed at Langley in recent years to eliminate the high intensity and high-frequency acoustic disturbances present in all previous supersonic wind tunnels are described. In conclusion, the low-disturbance levels present in atmospheric flight can now be simulated in wind tunnels over the speed range from low subsonic through high supersonic. Author

N88-14938*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND TUNNEL WALL INTERFERENCE **c09**
Perry A. Newman, Raymond E. Mineck, Richard W. Barnwell, and William B. Kemp, Jr. (College of William and Mary, Williamsburg, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 225-259 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

About a decade ago, interest in alleviating wind tunnel wall interference was renewed by advances in computational aerodynamics, concepts of adaptive test section walls, and plans for high Reynolds number transonic test facilities. Selection of NASA Langley cryogenic concept for the National Transonic Facility (NTF) tended to focus the renewed wall interference efforts. A brief overview and current status of some Langley sponsored transonic wind tunnel wall interference research are presented. Included are continuing efforts in basic wall flow studies, wall interference assessment/correction procedures, and adaptive wall technology. Author

N88-14939*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS OF MAGNETIC SUSPENSION TECHNOLOGY **c09**
Richmond P. Boyden and Ping Tcheng *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 261-277 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

The reasons for the continuing interest in the Magnetic Suspension and Balance System (MSBS) are highlighted. Typical problems that can arise because of model-support interference in a transonic wind tunnel are shown to illustrate the need for MSBS. The two magnetic suspension systems in operation at Langley are the only ones active in the U.S. One of these systems is the 13 inch MSBS which was borrowed from the Air Force Arnold Engineering Development Center. The other system is the 6 inch MSBS which was developed by MIT Aerophysics Laboratory with NASA and DOD funding. Each of these systems is combined with a subsonic wind tunnel. Ongoing research in both of these systems is covered. Last year, Madison Magnetics, Inc., completed a contractual design and cost study utilizing some advance concepts for a large MSBS which would be compatible with an 8 foot transonic wind tunnel and the highlights of the study are presented. Sverdrup Technology, Inc., recently performed a study under contract for Langley on the potential usefulness to the aerospace industry of a proposed large MSBS combined with a suitable transonic wind tunnel. The results of that study are discussed. Langley has partially funded the MSBS work at the University of Southampton for about 6 years under a grant arrangement and the major results are summarized. Author

N88-14940*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLOW DIAGNOSTICS AND VISUALIZATION IN WIND TUNNELS AND FLIGHT **c02**
P. C. Stainback, C. B. Johnson, B. J. Holmes, C. J. Obara, D. Carraway (Old Dominion Univ., Norfolk, Va.), J. F. Meyers, S. P. Wilkinson, W. C. Honaker, P. L. Lawing, and R. R. Antcliff et al. *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 279-310 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

The Langley Research Center has a concentrated and directed effort under way to develop both conventional and non-intrusive diagnostic instrumentation. These instruments are being developed to operate over large Mach number, total temperature, and total pressure ranges. Efforts are being made to evaluate the measurements made by the various instruments to determine the most accurate and reliable instrument to be used under a given flow environment. Although only one flow visualization technique was described, there are many different types presently being used at Langley Research Center. Author

N88-14941*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY CALIBRATION AND TEST RESULTS FROM THE NATIONAL TRANSONIC FACILITY **c09**
Linwood W. McKinney and Dennis E. Fuller *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 311-331 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

The National Transonic Facility (NTF) was operated to design condition of 120 million Reynolds number at a Mach number of 1.0. All systems were checked out except plenum isolation valves; modifications are being made to heaters on the actuators. Initial steady-state calibration indicates excellent steady flow characteristics. The first test of the Pathfinder 1 model indicated significant Reynolds number effects. Some effect of temperature on instrumentation were obtained. The cause of these effects is being evaluated. Author

N88-14942*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BOUNDARY LAYER TRANSITION **c34**

L. Maestrello, A. Bayliss, S. M. Mangalam, and M. R. Malik (High Technology Corp., Hampton, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 333-345 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

The boundary layer stability, its active control by sound and surface heating and the effect of curvature are studied numerically and experimentally for subsonic flow. In addition, the experimental and flight test data are correlated using the stability theory for supersonic Mach numbers. Active transition fixing and feedback control of boundary layer by sound interactions are experimentally investigated at low speed over an airfoil. Numerical simulation of active control by surface heating and cooling in air shows that by appropriate phase adjustment a reduction in the level of perturbation can be obtained. This simulation is based on the solution of two-dimensional compressible Navier-Stokes equations for a flat plate. Goertler vortices are studied experimentally on an airfoil in the Low Turbulence Pressure Tunnel (LTPT). The flow pattern was visualized using the sublimating chemical technique and data were obtained using a three component laser velocimeter. The effect of curvature on swept leading-edge stability on a cylinder was numerically studied. The results suggest that transition is dominated by traveling disturbance waves and that the waves with the greatest total amplification has an amplitude ratio of e sup 11. Experimental data from the quiet supersonic tunnel and flight tests are analyzed using linear compressible stability theory.
Author

N88-14943*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WALL TURBULENCE CONTROL **c09**
Stephen P. Wilkinson, A. Margrethe Lindemann, George B. Beeler, Catherine B. McGinley, Wesley L. Goodman, and R. Balasubramanian *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 347-360 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

A variety of wall turbulence control devices which were experimentally investigated are discussed; these include devices for burst control, alteration of outer flow structures, large eddy substitution, increased heat transfer efficiency, and reduction of wall pressure fluctuations. Control of pre-burst flow was demonstrated with a single, traveling surface depression which is phase-locked to elements of the burst production process. Another approach to wall turbulence control is to interfere with the outer layer coherent structures. A device in the outer part of a boundary layer was shown to suppress turbulence and reduce drag by opposing both the mean and unsteady vorticity in the boundary layer. Large eddy substitution is a method in which streamline curvature is introduced into the boundary layer in the form of streamwise vortices. Riblets, which were already shown to reduce turbulent drag, were also shown to exhibit superior heat transfer characteristics. Heat transfer efficiency as measured by the Reynolds Analogy Factor was shown to be as much as 36 percent greater than a smooth flat plate in a turbulent boundary layer. Large Eddy Break-Up (LEBU) which are also known to reduce turbulent drag were shown to reduce turbulent wall pressure fluctuation.
Author

N88-14944*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEPARATED FLOW **c34**
W. L. Sellers, III, R. E. Dunham, Jr., W. L. Goodman, F. G. Howard, R. J. Margason, D. H. Rudy, C. L. Rumsey, H. P. Stough, III, and J. L. Thomas *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 361-374 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

A brief overview of flow separation phenomena is provided. Langley has many active research programs in flow separation related areas. Three cases are presented which describe specific examples of flow separation research. In each example, a description of the fundamental fluid physics and the complexity of the flow field is presented along with a method of either reducing or controlling the extent of separation. The following examples are discussed: flow over a smooth surface with an adverse pressure gradient; flow over a surface with a geometric discontinuity; and flow with shock-boundary layer interactions. These results will show that improvements are being made in the understanding of flow separation and its control.
Author

N88-14945*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VORTEX DYNAMICS **c02**
George C. Greene, John E. Lamar, C. H. Liu, and L. R. Kubendran (National Academy of Sciences - National Research Council, Washington, D. C.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 375-392 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

Vortex flows of interest to aerodynamicists cover a wide range of scales from a fraction of an inch in boundary layer flows to many feet in wake flows. In many applications these flows are poorly understood and, due to their complexity, present a challenge both analytically and experimentally. Four topics representing the spectrum of experimental and analytical vortex research are presented.
Author

N88-14946*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OVERVIEW OF THE LANGLEY VISCOUS DRAG REDUCTION PROGRAM **c02**
Jerry N. Hefner *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 393-399 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

As a result of reductions in form drag and roughness drag, skin friction, drag, or viscous drag now represents a major contributor to the cruise drag of subsonic business and transport aircraft, and hence, is considered a barrier problem to further significant improvements in the aerodynamic efficiency of these aircraft. To meet the challenge, research in the areas of laminar-flow control and turbulence control/drag reduction was initiated at NASA Langley Research Center. The significance of this research is discussed.
B.G.

N88-14947*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED NATURAL LAMINAR FLOW AIRFOIL WITH HIGH LIFT TO DRAG RATIO **c02**
Jeffrey K. Viken, Werner Pfenninger (Engineering and Science Consultants, Grafton, Va.), and Robert J. McGhee *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 401-414 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

An experimental verification of a high performance natural laminar flow (NLF) airfoil for low speed and high Reynolds number applications was completed in the Langley Low Turbulence Pressure Tunnel (LTPT). Theoretical development allowed for the achievement of 0.70 chord laminar flow on both surfaces by the use of accelerated flow as long as tunnel turbulence did not cause upstream movement of transition with increasing chord Reynolds number. With such a rearward pressure recovery, a concave type deceleration was implemented. Two-dimensional theoretical analysis indicated that a minimum profile drag coefficient of 0.0026 was possible with the desired laminar flow at the design condition. With the three-foot chord two-dimensional model constructed for the LTPT experiment, a minimum profile drag coefficient of 0.0027 was measured at c sub l = 0.41 and Re sub c = 10 x 10 to the 6th power. The low drag bucket was shifted over a considerably large c sub l range by the use of the 12.5 percent chord trailing edge flap. A two-dimensional lift to drag ratio (L/D) was 245. Surprisingly high c sub l max values were obtained for an airfoil of this type. A 0.20 chort split flap with 60 deg deflection was also implemented to verify the airfoil's lift capabilities. A maximum

lift coefficient of 2.70 was attained at Reynolds numbers of 3 and 6 million. Author

N88-14948*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL DESIGN OF NATURAL LAMINAR FLOW WINGS FOR TRANSONIC TRANSPORT APPLICATION c02
Edgar G. Waggoner, Richard L. Campbell, Pamela S. Phillips, and Jeffrey K. Viken (Engineering and Science Consultants, Grafton, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 415-443 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

Two research programs are described which directly relate to the application of natural laminar flow (NLF) technology to transonic transport-type wind planforms. Each involved using state-of-the-art computational methods to design three-dimensional wing contours which generate significant runs of favorable pressure gradients. The first program supported the Variable Sweep Transition Flight Experiment and involves design of a full-span glove which extends from the leading edge to the spoiler hinge line on the upper surface of an F-14 outer wing panel. Boundary-layer and static-pressure data will be measured on this design during the supporting wind-tunnel and flight tests. These data will then be analyzed and used to infer the relationship between crossflow and Tollmein-Schlichting disturbances on laminar boundary-layer transition. A wing was designed computationally for a corporate transport aircraft in the second program. The resulting wing design generated favorable pressure gradients from the leading edge aft to the mid-chord on both upper and lower surfaces at the cruise design point. Detailed descriptions of the computational design approach are presented along with the various constraints imposed on each of the designs. Wing surface pressure distributions, which support the design objective and were derived from transonic three-dimensional analyses codes, are also presented. Current status of each of the research programs is included in the summary. Author

N88-14949*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NATURAL LAMINAR FLOW NACELLE FOR TRANSPORT AIRCRAFT c05
Milton Lamb, William K. Abeyounis, James C. Patterson, Jr., and Richard J. Re *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 445-460 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

The potential of laminar flow nacelles for reducing installed engine/nacelle drag was studied. The purpose was twofold: to experimentally verify a method for designing laminar flow nacelles and to determine the effect of installation on the extent of laminar flow on the nacelle and on the nacelle pressure distributions. The results of the isolated nacelle tests illustrated that laminar flow could be maintained over the desired length. Installing the nacelles on wing/pylon did not alter the extent of laminar flow occurring on the nacelles. The results illustrated that a significant drag reduction was achieved with this laminar flow design. Further drag reduction could be obtained with proper nacelle location and pylon contouring. B.G.

N88-14950*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT RESEARCH ON NATURAL LAMINAR FLOW c34
B. J. Holmes, C. C. Croom, E. C. Hastings, Jr., C. J. Obara, and C. P. vanDam (Vigyan Research Associates, Inc., Hampton, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 461-474 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

Five decades of flight experiences with natural laminar flow (NLF) have provided a basis of understanding how this technology can be used for reduction of viscous drag on modern practical aircraft. The effects of cruise unit Reynolds number on NLF achievability and maintainability; compressibility effects on Tollmein-Schlichting growth; flight experiment on the Cessna Citation III business jet; flight instrumentation on Lear 28/29; OV-1 NLF engine nacelle experiments; and viscous drag reduction are examined. B.G.

N88-14951*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND EXPERIMENTAL EVALUATION OF A SWEPT SUPERCRITICAL LAMINAR FLOW CONTROL (LFC) AIRFOIL c05
W. D. Harvey, C. D. Harris, C. W. Brooks, P. G. Clukey, and J. P. Stack *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 475-484 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

A large chord swept supercritical laminar flow control (LFC) airfoil was designed, constructed, and tested in the NASA Langley 8-ft Transonic Pressure Tunnel (TPT). The LFC airfoil experiment was established to provide basic information concerning the design and compatibility of high-performance supercritical airfoils with suction boundary layer control achieved through discrete fine slots or porous surface concepts. It was aimed at validating prediction techniques and establishing a technology base for future transport designs and drag reduction. Good agreement was obtained between measured and theoretically designed shockless pressure distributions. Suction laminarization was maintained over an extensive supercritical zone up to high Reynolds numbers before transition gradually moved forward. Full-chord laminar flow was maintained on the upper and lower surfaces at M sub infinity = 0.82 up to R sub c is less than or equal to 12 x 10 to the 6th power. When accounting for both the suction and wake drag, the total drag could be reducted by at least one-half of that for an equivalent turbulent airfoil. Specific objectives for the LFC experiment are given. Author

N88-14952*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LAMINAR FLOW INTEGRATION: FLIGHT TESTS STATUS AND PLANS c34
R. D. Wagner, D. F. Fisher, M. C. Fischer, D. W. Bartlett, and R. R. Meyer, Jr. (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 485-518 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

Under the Aircraft Energy Efficiency - Laminar Flow Control Program, there are currently three flight test programs under way to address critical issues concerning laminar flow technology application to commercial transports. The Leading-Edge Flight Test (LEFT) with a JetStar aircraft is a cooperative effort with the Ames/Dryden Flight Research Facility to provide operational experience with candidate leading-edge systems representative of those that might be used on a future transport. In the Variable Sweep Transition Flight Experiment (VSTFE), also a cooperative effort between Langley and Ames/Dryden, basic transition data on an F-14 wing with variable sweep will be obtained to provide a data base for laminar flow wing design. Finally, under contract to the Boeing Company, the acoustic environment on the wing of a 757 aircraft will be measured and the influence of engine noise on laminar flow determined with a natural laminar flow glove on the wing. The status and plans for these programs are reported. Author

N88-14953*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ROUGHNESS AND WAVINESS REQUIREMENTS FOR LAMINAR FLOW SURFACES c34
Clifford J. Obara (PRC Kentron, Inc., Hampton, Va.) and Bruce J. Holmes *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 519-537 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

Many modern metal and composite airframe manufacturing techniques can provide surface smoothness which is compatible with natural laminar flow (NLF) requirements. An important consideration is manufacturing roughness of the surface in the form of steps and gaps perpendicular to the freestream. The principal challenge to the design and manufacture of laminar flow surfaces today appears to be in the installation of leading-edge panels on wing, nacelle, and empennage surfaces. A similar challenge is in the installation of access panels, doors, windows, fuselage noses, and engine nacelles. Past work on roughness and waviness manufacturing tolerances and comparisons with more recent experiments are reviewed. B.G.

N88-14954*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INSECT CONTAMINATION PROTECTION FOR LAMINAR FLOW SURFACES **c05**
Cynthia C. Croom and Bruce J. Holmes *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 539-556 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

The ability of modern aircraft surfaces to achieve laminar flow was well-accepted in recent years. Obtaining the maximum benefit of laminar flow for aircraft drag reduction requires maintaining minimum leading-edge contamination. Previously proposed insect contamination prevention methods have proved impractical due to cost, weight, or inconvenience. Past work has shown that insects will not adhere to water-wetted surfaces, but the large volumes of water required for protection rendered such a system impractical. The results of a flight experiment conducted by NASA to evaluate the performance of a porous leading-edge fluid discharge ice protection system operated as an insect contamination protections system are presented. In addition, these flights explored the environmental and atmospheric conditions most suitable for insect accumulation. Author

N88-14955*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RIBLETS FOR AIRCRAFT SKIN-FRICTION REDUCTION **c05**
Michael J. Walsh *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 557-571 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

Energy conservation and aerodynamic efficiency are the driving forces behind research into methods to reduce turbulent skin friction drag on aircraft fuselages. Fuselage skin friction reductions as small as 10 percent provide the potential for a 250 million dollar per year fuel savings for the commercial airline fleet. One passive drag reduction concept which is relatively simple to implement and retrofit is that of longitudinally grooved surfaces aligned with the stream velocity. These grooves (riblets) have heights and spacings on the order of the turbulent wall streak and burst dimensions. The riblet performance (8 percent net drag reduction thus far), sensitivity to operational/application considerations such as yaw and Reynolds number variation, an alternative fabrication technique, results of extensive parametric experiments for geometrical optimization, and flight test applications are summarized. Author

N88-14956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRFOIL LARGE EDDY BREAKUP DEVICES FOR TURBULENT DRAG REDUCTION **c05**
J. B. Anders *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 573-585 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

It was determined from the present LaRC experiments that tandem, airfoil-shaped large eddy breakup (LEBU) devices can reduce local skin friction as much as 30 percent with a recovery region extending more than 100 boundary layer thicknesses downstream. These airfoils experience near laminar skin friction device drag and produce net drag reductions of up to 7 percent. In contrast to the thin plates used in previous experiments, these airfoils are more than 1000 time stiffer and hence have the potential to withstand the real flight environment (dynamic pressure 36 times larger than in low-speed wing tunnels). In addition, the higher Reynolds numbers of the present tests indicate drag reduction performance is at least as good (or better) as at lower Reynolds numbers. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N88-14957*# Tracor Hydronautics, Inc., Laurel, Md.
AN ENGINEERING STUDY OF HYBRID ADAPTATION OF WIND TUNNEL WALLS FOR THREE-DIMENSIONAL TESTING Final Report
Clinton Brown, Kenneth Kalumuck, and David Waxman Dec. 1987 99 p
(Contract NAS1-18184)
(NASA-CR-178374; NAS 1.26:178374) Avail: NTIS HC A05/MF A01 CSCL 01A

Solid wall tunnels having only upper and lower walls flexing are described. An algorithm for selecting the wall contours for both 2 and 3 dimensional wall flexure is presented and numerical experiments are used to validate its applicability to the general test case of 3 dimensional lifting aircraft models in rectangular cross section wind tunnels. The method requires an initial approximate representation of the model flow field at a given lift with walls absent. The numerical methods utilized are derived by use of Green's source solutions obtained using the method of images; first order linearized flow theory is employed with Prandtl-Glauert compressibility transformations. Equations are derived for the flexed shape of a simple constant thickness plate wall under the influence of a finite number of jacks in an axial row along the plate centerline. The Green's source methods are developed to provide estimations of residual flow distortion (interferences) with measured wall pressures and wall flow inclinations as inputs. Author

N88-14958# United Technologies Research Center, East Hartford, Conn.
UNSTEADY STALL PENETRATION EXPERIMENTS AT HIGH REYNOLDS NUMBER Final Report, 14 Aug. 1984 - 14 Feb. 1987
Peter F. Lorber and Franklin O. Carta 14 Apr. 1987 204 p
(Contract F49620-84-C-0082)
(AD-A186120; UTRC/R87-956939-3; AFOSR-87-1202TR) Avail: NTIS HC A10/MF A01 CSCL 20D

An experiment was performed to examine the unsteady aerodynamics of stall penetration at constant pitch rate and high Reynolds number, in an attempt to more accurately model conditions during aircraft post-stall maneuvers and during helicopter high speed forward flight. The model spanned the 8 ft wind tunnel and consisted of a 17.3 in. chord wing with a Sikorsky SSC-AOQ airfoil section. Two forms of pitching motion were used: constant pitch rate ramps and sinusoidal oscillations. Ramp data were obtained for 36 test points at pitch rates between 0.001 and 0.020, Mach numbers between 0.2 and 0.4, and Reynolds numbers between 2 and 4 million. Sinusoidal data were obtained for an additional 9 conditions. The results demonstrate the influence of the leading edge stall vortex on the unsteady aerodynamic response during and after stall. The vortex-related unsteady increments to the lift, drag, and pitching moment increase with pitch rate; the maximum delta C sub L is 1.2 at A =0.02. Angular delays in stall events also increase with pitch rate. Vortex strength and propagation velocity were determined from pressures induced on the airfoil surface. The vortex is strengthened by increasing the pitch rate, and is weakened both by increasing the Mach

number and by starting the motion close to the steady-state stall angle. Propogation velocity increases linearly with pitch rate. GRA

N88-14959# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FUNDAMENTAL ASPECTS OF THE STRUCTURE OF SUPERSONIC TURBULENT BOUNDARY Annual Report, Apr. 1986 - May 1987
Jonathan H. Watmuff and Alexander J. Smits May 1987 41 p
(Grant AF-AFOSR-0126-85)
(AD-A186366; AFOSR-87-1269TR; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20D

Measurements of structure angle in a supersonic turbulent boundary layer with zero and adverse pressure gradients are presented. Conditionally sampled measurements of u,v, and UV are presented along with quadrant analysis of the turbulent fluctuations. The latter suggests ambiguities associated with the interpretation of VITA measurements. Preliminary results of experiments on artificially generated hairpin vortices are also discussed. Measurements indicate a high degree of similarity between the signatures of these hairpin structures and ensemble averaged events in the turbulent boundary layer. GRA

N88-14960*# Douglas Aircraft Co., Inc., Long Beach, Calif.
LAMINAR FLOW CONTROL LEADING EDGE GLOVE FLIGHT TEST ARTICLE DEVELOPMENT Final Report
W. E. Pearce, D. E. McNay, and J. A. Thelander Nov. 1984 112 p
(Contract NAS1-16220)
(NASA-CR-172137; NAS 1.26:172137) Avail: NTIS HC A06/MF A01 CSCL 01A

A laminar flow control (LFC) flight test article was designed and fabricated to fit into the right leading edge of a JetStar aircraft. The article was designed to attach to the front spar and fill in approx. 70 inches of the leading edge that are normally occupied by the large slipper fuel tank. The outer contour of the test article was constrained to align with an external fairing aft of the front spar which provided a surface pressure distribution over the test region representative of an LFC airfoil. LFC is achieved by applying suction through a finely perforated surface, which removes a small fraction of the boundary layer. The LFC test article has a retractable high lift shield to protect the laminar surface from contamination by airborne debris during takeoff and low altitude operation. The shield is designed to intercept insects and other particles that could otherwise impact the leading edge. Because the shield will intercept freezing rain and ice, a oozing glycol ice protection system is installed on the shield leading edge. In addition to the shield, a liquid freezing point depressant can be sprayed on the back of the shield. Author

N88-14961# Hokenson (Gustave J.), Los Angeles, Calif.
TURBULENCE IN HYPERSONIC FLOW Final Report, 15 Dec. 1986 - 14 Jun. 1987
Gustave J. Hokenson 1 Jul. 1987 79 p
(Contract F49620-87-C-0012)
(AD-A185624; HOKE-THC-02GH87071A; AFOSR-87-1034TR)
Avail: NTIS HC A05/MF A01 CSCL 20D

Numerical simulations of hypersonic shear flow, utilizing the full-time-dependent compressible flow Navier-Stokes equations, have been carried out to demonstrate the feasibility of exposing, computationally, the essential structure/physic of turbulent fluctuations in high speed flow. The geometry employed is one of interest to the U.S. Air Force in various applications, namely a right circular cylinder whose axis is aligned with the on-coming flow and around which the cylinder could be rotated. By simulating the flow along a cylinder of infinite axial extent, an exceptionally quiet flow was established. Due to limitations of computational time, it was necessary to excite artificially this flowfield with periodic suction and blowing located well upstream of the obervation plane. As a result, fluctuations in the flowfield entropy, vorticity and pressure were observed which revealed a distinct Mach number dependence. At hypersonic Mach numbers, the fluctuating entropy defined a second boundary layer edge, well beyond that of the vorticity but not propagating deep into the inviscid, flow, as was observed in both transonic and supersonic regimes. GRA

N88-14962*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFT DISTRIBUTION AND VELOCITY FIELD MEASUREMENTS FOR A THREE-DIMENSIONAL, STEADY BLADE/VORTEX INTERACTION
Stephen E. Dunagan and Thomas R. Norman Nov. 1987 39 p
(NASA-TM-100013; A-87306; NAS 1.15:100013) Avail: NTIS HC A03/MF A01 CSCL 01A

A wind tunnel experiment simulating a steady three-dimensional helicopter rotor blade/vortex interaction is reported. The experimental configuration consisted of a vertical semispan vortex-generating wing, mounted upstream of a horizontal semispan rotor blade airfoil. A three-dimensional laser velocimeter was used to measure the velocity field in the region of the blade. Sectional lift coefficients were calculated by integrating the velocity field to obtain the bound vorticity. Total lift values, obtained by using an internal strain-gauge balance, verified the laser velocimeter data. Parametric variations of vortex strength, rotor blade angle of attack, and vortex position relative to the rotor blade were explored. These data are reported (with attention to experimental limitations) to provide a dataset for the validation of analytical work. Author

N88-14963# Pacific Northwest Labs., Richland, Wash.
MEASUREMENT IN A WIND TUNNEL OF THE MODIFICATION OF MEAN WIND AND TURBULENCE CHARACTERISTICS DUE TO INDUCTION EFFECTS NEAR WIND TURBINE ROTORS
D. E. Neff and R. N. Meroney Aug. 1987 146 p
(Contract DE-AC06-76RL-01830)
(DE88-000249; PNL-6248) Avail: NTIS HC A07/MF A01

Experimental data on the wind field surrounding a single model wind turbine rotor disk is given. These data should provide an improved physical insight into the induction effects of the air flow as it approaches the wind turbine, which should in turn improve an analytical model's predictive capabilities. A scaled model of a horizontal-axis wind turbine (a two-bladed rotor of diameter 53 cm) was placed into the Meteorological Wind Tunnel (MWT) facility at Colorado State University (cross-section width of 183 cm). Four different approach flow conditions were studied: low and moderate turbulence levels (0.1 percent and 1.5 percent intensity) at both 6 and 7.6 m/s freestream air velocities. For each of these flow conditions the rotor power coefficient versus tip speed ratio was obtained, and the 3-D velocity field from 3 rotor diameters upwind to 0.5 diameter downwind was tabulated. The power output of the rotor was obtained via a simple prony brake friction device that imparts a torque (measured by the deflection of a spring) to the spinning shaft of the wind turbine. The rotor speed, measured by a strobe light, was observed to vary with load from 900 rpm up to 2100 rpm for the flow conditions described above. The 3-D velocity field was measured via a three-hot-film probe. Details of the measurement techniques are provided. The test program and data results are also given. A short discussion of the implications of this data set is included. DOE

N88-14964# Poitiers Univ. (France). Centre d'Etudes Aerodynamiques et Thermiques.
EXAMINATION OF THE DEVELOPMENT OF A COMPRESSIBLE TURBULENT BOUNDARY LAYER ON A ROUGH AND POROUS WALL
A. Stassinopoulos and R. Leblanc Jun. 1986 91 p In FRENCH Sponsored by Direction des Recherches, Etudes et Techniques, Paris, France
(PB87-148266) Avail: NTIS HC E05/MF E05 CSCL 01A

The objective of the research program is the perfection of a method of anticipating the development of a compressible turbulent boundary layer on a plane wall in the presence of a mass transfer. It follows the detailed analysis of the interaction between an oblique shock wave and a turbulent boundary layer experiencing an aspiration or a blast conducted previously. The interaction is an important phenomenon in compressible aerodynamics. The type

of flow is encountered frequently both in external aerodynamics on the top and bottom wing faces and the controls, and in internal aerodynamics in air inlets and on the turbo engine vanes. GRA

N88-14965*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MODERN WING FLUTTER ANALYSIS BY COMPUTATIONAL FLUID DYNAMICS METHODS
Herbert J. Cunningham, John T. Batina, and Robert M. Bennett Jan. 1988 11 p Presented at the ASME Winter Annual Meeting, Boston, Mass. 13-18 Dec. 1987
(NASA-TM-100531; NAS 1.15:100531; ASME-Paper-87-WA/Aero-9) Avail: NTIS HC A03/MF A01 CSCL 01A

The application and assessment of the recently developed CAP-TSD transonic small-disturbance code for flutter prediction is described. The CAP-TSD code has been developed for aeroelastic analysis of complete aircraft configurations and was previously applied to the calculation of steady and unsteady pressures with favorable results. Generalized aerodynamic forces and flutter characteristics are calculated and compared with linear theory results and with experimental data for a 45 deg sweptback wing. These results are in good agreement with the experimental flutter data which is the first step toward validating CAP-TSD for general transonic aeroelastic applications. The paper presents these results and comparisons along with general remarks regarding modern wing flutter analysis by computational fluid dynamics methods. Author

N88-14966*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
A FLOW VISUALIZATION STUDY OF THE LEADING EDGE SEPARATION BUBBLE ON A NACA 0012 AIRFOIL WITH SIMULATED GLAZE ICE Final Report M.S. Thesis
Abdollah Khodadoust Jan. 1988 91 p
(Contract NAG3-28)
(NASA-CR-180846; NAS 1.26:180846) Avail: NTIS HC A05/MF A01 CSCL 01A

As a part of the ongoing research in aircraft icing, the leading edge separation bubble on the NACA 0012 model with a 5-min simulated glaze ice was investigated. The flow visualization methods used oil, tuft, splitter plate, smoke, and liquid crystals to get reattachment line data for the leading edge separation bubble on both surfaces of the airfoil. On the upper surface, the bubble was found to grow larger with increasing negative angles of attack and reduce in size with increasing angles of attack. The separated flow fails to reattach beyond 6 deg for the upper surface and -5 deg for the lower surface. The results of this study compared well with those of other experiments and computational results. Author

N88-14967*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPLICIT RUNGE-KUTTA METHOD FOR UNSTEADY ROTOR/STATOR INTERACTION
Philip C. E. Jorgenson and Rodrick V. Chima Jan. 1988 15 p Prepared for presentation at the 26th Aerospace Sciences Meeting, Reno, Nev., 11-14 Jan. 1988; sponsored by AIAA
(NASA-TM-100787; E-3959; NAS 1.15:100787; AIAA-88-0049)
Avail: NTIS HC A03/MF A01 CSCL 01A

A quasi-three-dimensional rotor/stator analysis has been developed for blade-to-blade flows in turbomachinery. The analysis solves the unsteady Euler or thin-layer Navier-Stokes equations in a body-fitted coordinate system. It accounts for the effects of rotation, radius change, and stream-surface thickness. The Baldwin-Lomax eddy-viscosity model is used for turbulent flows. The equations are integrated in time using a four-stage Runge-Kutta scheme with a constant timestep. Results are shown for the first stage of the Space Shuttle Main Engine high pressure fuel turbopump. Euler and Navier-Stokes results are compared on the scaled single- and multi-passage machine. The method is relatively fast and the quasi-three-dimensional formulation is applicable to a wide range of turbomachinery geometries. Author

N88-14968*# Vigyan Research Associates, Inc., Hampton, Va.
AN ANALYTICAL METHOD FOR DITCHING ANALYSIS OF AN AIRBORNE VEHICLE
Farhad Ghaffari Washington, D.C. NASA Feb. 1988 53 p
(Contract NAS1-17919)
(NASA-CR-4120; NAS 1.26:4120) Avail: NTIS HC A04/MF A01 CSCL 01A

A simple analytical method has been introduced for aerohydrodynamic load analysis of an airborne configuration during water ditching. The method employs an aerodynamic panel code, based on linear potential flow theory, to simulate the flow of air and water around an aircraft configuration. The free surface separating the air and water region is represented by doublet sheet singularities. Although all the theoretical load distributions are computed for air, provisions are made to correct the pressure coefficients obtained on the configuration wetted surfaces to account for the water density. As an analytical tool, the Vortex Separation Aerodynamic (VSAERO) code is chosen to carry out the present investigation. After assessing the validity of the method, its first application is to analyze the water ditching of the Space Shuttle configuration at a 12 degree attitude. Author

N88-14969*# Applied and Theoretical Mechanics, Inc., Oakland, Calif.
INCOMPRESSIBLE VISCOUS FLOW SIMULATIONS OF THE NFAC WIND TUNNEL Final Report, Jun. 1985 - Jun. 1986
Joelle Milene Champney Jun. 1986 91 p Submitted for publication
(Contract NAS2-12187)
(NASA-CR-177431; NAS 1.26:177431; ATM-FR-25-012) Avail: NTIS HC A05/MF A01 CSCL 01A

The capabilities of an existing 3-D incompressible Navier-Stokes flow solver, INS3D, are extended and improved to solve turbulent flows through the incorporation of zero- and two-equation turbulence models. The two-equation model equations are solved in their high Reynolds number form and utilize wall functions in the treatment of solid wall boundary conditions. The implicit approximate factorization scheme is modified to improve the stability of the two-equation solver. Applications to the 3-D viscous flow inside the 80 by 120 feet open return wind tunnel of the National Full Scale Aerodynamics Complex (NFAC) are discussed and described. Author

N88-14928*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FINITE-VOLUME SCHEME FOR TRANSONIC POTENTIAL FLOW ABOUT AIRFOILS AND BODIES IN AN ARBITRARILY SHAPED CHANNEL
Jerry C. South, Jr., Michael L. Doria (Valparaiso Univ., Ind.), and Lawrence L. Green *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 25-43 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14929*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BREAKDOWN OF THE CONSERVATIVE POTENTIAL EQUATION
M. D. Salas and C. R. Gumbert *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 45-71 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14931*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
UPWIND RELAXATION ALGORITHMS FOR EULER/NAVIER-STOKES EQUATIONS
J. L. Thomas, R. W. Walters, D. H. Rudy, and R. C. Swanson *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 89-107 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14932*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A MULTISTAGE TIME-STEPPING SCHEME FOR THE THIN-LAYER NAVIER-STOKES EQUATIONS
R. C. Swanson, Jr., Eli Turkel (Tel-Aviv Univ., Israel), and V. N. Vatsa *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 109-135 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14934*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VISCOUS VORTEX FLOWS
R. P. Weston, J. P. Chamberlain, C. H. Liu, and Peter-Michael Hartwich *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 153-168 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14935*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A THEORY FOR THE CORE FLOW OF LEADING-EDGE VORTICES
James M. Luckring *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 169-185 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14940*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLOW DIAGNOSTICS AND VISUALIZATION IN WIND TUNNELS AND FLIGHT
P. C. Stainback, C. B. Johnson, B. J. Holmes, C. J. Obara, D. Carraway (Old Dominion Univ., Norfolk, Va.), J. F. Meyers, S. P. Wilkinson, W. C. Honaker, P. L. Lawing, and R. R. Antcliff et al. *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 279-310 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14945*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VORTEX DYNAMICS
George C. Greene, John E. Lamar, C. H. Liu, and L. R. Kubendran (National Academy of Sciences - National Research Council, Washington, D. C.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 375-392 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14946*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OVERVIEW OF THE LANGLEY VISCOUS DRAG REDUCTION PROGRAM
Jerry N. Hefner *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 393-399 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14947*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED NATURAL LAMINAR FLOW AIRFOIL WITH HIGH LIFT TO DRAG RATIO
Jeffrey K. Viken, Werner Pfenninger (Engineering and Science Consultants, Grafton, Va.), and Robert J. McGhee *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 401-414 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

N88-14948*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL DESIGN OF NATURAL LAMINAR FLOW WINGS FOR TRANSONIC TRANSPORT APPLICATION
Edgar G. Waggoner, Richard L. Campbell, Pamela S. Phillips, and Jeffrey K. Viken (Engineering and Science Consultants, Grafton, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 415-443 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N88-14970*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND SHEAR DETECTION. FORWARD-LOOKING SENSOR TECHNOLOGY
E. M. Bracalente, comp. and V. E. Delnore, comp. (PRC Kentron, Inc., Hampton, Va.) Oct. 1987 282 p Presented at the 1st Industry Review, Hampton, Va., 24-25 Feb. 1987
(NASA-CP-10004; NAS 1.55:10004; DOT/FAA/PS-87/2) Avail: NTIS HC A13/MF A01 CSCL 01C

A meeting took place at NASA Langley Research Center in February 1987 to discuss the development and eventual use of forward-looking remote sensors for the detection and avoidance of wind shear by aircraft. The participants represented industry, academia, and government. The meeting was structured to provide first a review of the current FAA and NASA wind shear programs, then to define what really happens to the airplane, and finally to give technology updates on the various types of forward-looking sensors. This document is intended to informally record the essence of the technology updates (represented here through unedited duplication of the vugraphs used), and the floor discussion following each presentation. Also given are key issues remaining unresolved. Author

N88-14971# Naval Postgraduate School, Monterey, Calif.
AN INDEPENDENT EVALUATION OF THE CH-46 SAFETY RELIABILITY AND MAINTAINABILITY PROGRAM (SR AND M) M.S. Thesis
Michael J. Conklin Sep. 1987 50 p
(AD-A186310) Avail: NTIS HC A03/MF A01 CSCL 01C

This thesis is an independent partial evaluation of the Safety Reliability and Maintainability Program (SR&M). The two Measures of effectiveness which were used to see if the goals of this program were realized in the areas of maintainability and reliability are the maintenance Man-hours per Flight Hour and the Mean Flight Hours Between failures. Standard statistical analysis was performed utilizing the software packages GRAFSTAT and MINITAB. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N88-14972# Naval Surface Weapons Center, Silver Spring, Md.
DETERMINATION OF TRANET (TRACKING STATION COORDINATES FOR TRACKING NETWORK) AND SMTP (SPECIAL MISSION TRACKING PROGRAM) TRACKING STATION COORDINATES FOR USE IN THE WGS (WORLD GEODETIC SYSTEM) 84 Final Report
James P. Cunningham Jun. 1987 33 p
(Contract MIPR-HM0027-86-C048)
(AD-A185863; NSWC-TR-87-61) Avail: NTIS HC A03/MF A01 CSCL 17G

In collaboration with the Defense Mapping Agency (DMA), an effort to prepare Doppler tracking station coordinates for precise NNSS orbit computation in the World Geodetic System 1984 (WGS 84) has been concluded. The level of random and systematic errors in the new coordinates is believed to be significantly lower than in any previous coordinate set, including those used for production orbit computation at DMAHTC. Additionally, the accuracy of Doppler determination of the earth's instantaneous spin axis in the orbit computation has been similarly improved. GRA

N88-14973# Computer Technology Associates, Inc., Colorado Springs, Colo.

FAA AIR TRAFFIC CONTROL OPERATIONS CONCEPTS. VOLUME 1: ATC BACKGROUND AND ANALYSIS METHODOLOGY Final Report

H. L. Ammerman, E. S. Becker, G. W. Jones, W. K. Tobey, and M. D. Phillips 6 Jul. 1987 255 p

(Contract DTF-A01-85-Y-010304)

(AD-A185979; DOT/FAA/AP-87-01-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 17G

The series of volumes documents the operations concepts for operational air traffic control (ATC) positions in the Advanced Automation System (AAS). AAS operational positions involve interaction with advanced radar and flight data displays, as well as other automated ATC functions, through a sector suite workstation or position console. Volume I of the series includes material common to all positions. Operations in today's facilities (pre-AAS centers, towers, and TRACONs), the automated capabilities planned for AAS, and the methodology used to analyze the operations concept for a particular ATC position are described in Volume 1. Volume 1 includes definitions of air traffic events, baseline operational scenarios, glossaries of task and element action verbs, glossary of ATC terms, and list of acronyms used in the documents. GRA

N88-14974# Computer Technology Associates, Inc., Colorado Springs, Colo.

FAA AIR TRAFFIC CONTROL OPERATIONS CONCEPTS. VOLUME 2: ACF/ACCC (AREA CONTROL FACILITY/AREA CONTROL COMPUTER COMPLEX) TERMINAL AND EN ROUTE CONTROLL ERS Final Report

H. L. Ammerman, E. S. Becker, C. A. Claussen, E. E. Inman, and G. W. Jones 6 Jul. 1987 365 p

(Contract DTF-A01-85-Y-010304)

(AD-A185980; DOT/FAA/AP-87-01-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 01E

This volume is one of a series of operations concepts for the FAA's Advanced Automation System (AAS). It describes how terminal and en route controllers in the Area Control Facilities may perform their operational jobs in the full Air Control Computer Complex (ACCC) environment. ACCC functionality is assumed to be as described in the AAS System Level Specification, 24 April 1987. Included are: composition graphs, showing the logical flow of operation tasks performed in response to or anticipation of external air traffic events; a series of analyses of these tasks, including task information requirements, cognitive/sensory attributes, performance criteria, and summary dialogue description; and a user interface language aggregating system. Data presented here are generated and maintained using the Computer-Human Operational Requirements Analysis System (CHORAS). CHORAS includes an automated task data base, specialized graphing capabilities, and display and hard copy output features tailored to the needs of operations concept analysis. GRA

N88-14975# Computer Technology Associates, Inc., Colorado Springs, Colo.

FAA AIR TRAFFIC CONTROL OPERATIONS CONCEPTS. VOLUME 3: ISSS (INITIAL SECTOR SUITE SYSTEM) EN ROUTE CONTROLLERS Final Report

H. L. Ammerman, C. A. Claussen, E. E. Inman, and W. K. Tobey 6 Jul. 1987 622 p

(Contract DTF-A01-85-Y-010304)

(AD-A185981; DOT/FAA/AP-87-01-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 01E

This volume is one of a series of operations concepts for the FAA's Advanced Automation System (AAS). It describes how en route controllers in Air Route Traffic Control facilities may perform their operational jobs in the Initial Sector Suite System (ISSS) environment. ISSS functionality is assumed to be as described in the AAS System Level Specification, 24 April 1987. Included here are: composition graphs, showing the logical flow of operational tasks performed in response to or anticipation of external air traffic events; a series of analyses of these tasks, including task information requirements, cognitive/sensory attributes, performance criteria, and summary dialogue description; a user interface language aggregating system input and output messages in a hierarchical organization; decomposition of tasks to their constituent procedural elements; traceability between tasks and supporting ISSS functionality; and sample operational scenarios for each position. Data presented here are generated and maintained using the Computer-Human Operational Requirements Analysis System (CHORAS). CHORAS includes an automated task data base, specialized graphing capabilities, and display and hard copy output features tailored to the needs of operations concept analysis. GRA

N88-14976# Computer Technology Associates, Inc., Colorado Springs, Colo.

FAA AIR TRAFFIC CONTROL OPERATIONS CONCEPTS. VOLUME 4: TAAS (TERMINAL ADVANCED AUTOMATION SYSTEM) TERMINAL CONTROLLERS Final Report

H. L. Ammerman, C. A. Claussen, E. E. Inman, G. W. Jones, and B. E. Melville 6 Jul. 1987 504 p

(Contract DTF-A01-85-Y-010304)

(AD-A185982; DOT/FAA/AP-87-01-Vol-4) Avail: NTIS HC A22/MF A01 CSCL 01E

This volume is one of a series of operations concepts for the FAA's Advanced Automation System (AAS). It describes how terminal controllers in TRACON facilities may perform their operational jobs in the Terminal Advanced Automation System (TAAS) environment. TAAS functionality is assumed to be as described in the AAS System Level Specification, 24 April 1987. Included here are: composition graphs, showing the logical flow of operational tasks performed in response to or anticipation of external air traffic events; a series of analyses of these tasks, including task information requirements, cognitive/sensory attributes, performance criteria, and summary dialogue description; a user interface language aggregating system input and output messages in a hierarchical organization; decomposition of tasks to their constituent procedural elements; traceability between tasks and supporting TAAS functionality; and sample operational scenarios for each position. Data presented here are generated and maintained using the Computer-Human Operational Requirements Analysis System (CHORAS). CHORAS includes an automated task data base, specialized graphing capabilities, and display and hard copy output features tailored to the needs of operations concept analysis. GRA

N88-14977# Computer Technology Associates, Inc., Colorado Springs, Colo.

FAA AIR TRAFFIC CONTROL OPERATIONS CONCEPTS. VOLUME 5: ATCT/TCCC (AIRPORT TRAFFIC CONTROL TOWER/TOWER CONTROL COMPUTER COMPLEX) TOWER CONTROLLERS Final Report

H. L. Ammerman, E. S. Becker, L. J. Bergen, C. A. Claussen, and D. K. Davies 31 Jul. 1987 699 p

(Contract DTF-A01-85-Y-010304)

(AD-A185983; DOT/FAA/AP-87-01-Vol-5) Avail: NTIS HC A99/MF A02 CSCL 01E

This volume is one of a series of operations concepts for the FAA's Advanced Automation System (AAS). It describes how Tower controllers in the Airport Traffic Control Towers (ATCT) may perform their operational jobs in the full tower control computer complex (TCCC) environment. TCCC functionally is assumed to be as described in the AAS System Level Specification, 24 April 1987.

Separate analyses are presented for the three basic control positions: Local Control, Ground Control, and Clearance Delivery/Flight Data. Included here are: composition graphs showing the logical flow of operational tasks performed in response to or anticipation of external air traffic events; a series of analyses of these tasks, including task information requirements, cognitive/sensory attributes, performance criteria, and summary dialogue description; a user interface language aggregating system input and output messages in a hierarchical organization; decomposition of tasks to their constituent procedural element; and traceability between tasks and supporting TCCC functionality. Data presented here are generated and maintained using the Computer-Human Operational Requirements Analysis System (CHORAS). CHORAS includes an automated task data base, specialized graphing capabilities, and display and hard copy output features tailored to the needs of operations concept analysis. GRA

N88-14978# Minority Services, Inc., Washington, D.C.
MICROWAVE LANDING SYSTEM (MLS) MATHEMATICAL MODEL INSTALLATION MANUAL Technical Note, Jun. 1986 - Feb. 1987
Jesse D. Jones May 1987 28 p
(Contract DTFA03-86-C-0055)
(AD-A185612; DOT/FAA/CT-TN87/17) Avail: NTIS HC A03/MF A01 CSCL 17G

This Technical Note provides requirements and guidance for the installation of the baselined microwave landing system (MLS) mathematical model. This model originated at the Massachusetts Institute of Technology, Lincoln Laboratory, during the late 1970's, and has been revised and baselined to facilitate future software support and improvements. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles see *85 Urban Technology and Transportation*.

N88-14979# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
FLAPS-UP TAKOFF PERFORMANCE OF THE OV-1D AIRCRAFT WITH YT53-L-704 ENGINE INSTALLED Final Report, 9 Feb. 1986 - 3 Feb. 1987
Joseph C. Miess, George M. Yamakawa, Jeffrey L. Linehan, and Robert D. Robbins May 1987 69 p
(AD-A185960; AD-F000114) Avail: NTIS HC A04/MF A01 CSCL 01B

The flaps-up procedure eliminates the portion of the takeoff profile where the aircraft cannot accelerate because the flaps are down and the flaps cannot be retracted because the airspeed is below flaps-up minimum control speed. Flaps-up procedures avoided the temporary altitude loss which occurred with the flaps-15 takeoff procedure when the flaps were retracted at high gross weight/density altitude conditions. Flaps-up takeoffs should be incorporated into operational unit procedures. Accelerate-stop distance using wheel brakes only was excessive. The brakes became overheated and ineffective. Ineffectiveness of the OV/RV-1D wheel brake system is a deficiency. A procedure using aerodynamic braking with speed brakes and a flaps-45 setting was developed and used effectively to slow the aircraft until elevator effectiveness was lost, then wheel brakes were used to bring the aircraft to a stop. The aerodynamic braking procedure should be incorporated into the Aircrew Training Manual program. An anti-skid wheel brake system should be incorporated on the OV/RV-1D aircraft. Single-engine ground minimum control speed (v sub meg) was 55 knots indicated airspeed (KIAS) for flaps-up and 50 KIAS for flaps-15. OV-1D V (sub meg) characteristics are satisfactory. GRA

N88-14980# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PRELIMINARY AIRWORTHINESS EVALUATION OF A UH-1 EQUIPPED WITH A TERRAIN MAPPING RECEIVER ANTENNA Final Report
Frederick W. Stellar, James D. Brown, and Christopher P. Butler Feb. 1987 38 p
(AD-A186274; USAAEFA-86-20) Avail: NTIS HC A03/MF A01 CSCL 17I

The preliminary airworthiness evaluation of the UH-1H helicopter equipped with the receiver antenna of the Terrain Mapping Radar System was conducted in Lakehurst, New Jersey, between 21 November and 8 December 1986. The evaluation required 12 flights for a total of 14.8 hours, or which 12.0 hours were productive. Performance, handling qualities, and structural dynamic response tests were conducted. The modified UH-1H equipped with the receiver antenna demonstrated adequate handling qualities for the terrain mapping mission. However, the proposed mission profile requires extensive operation of the helicopter in an out-of-ground effect (OGE) hover. Although the handling qualities are acceptable, the degraded autorotational characteristics may preclude a safe autorotational landing in the event of a sudden engine failure at an OGE hover below 1000 feet above ground level. The minimum directional control margin and high pilot workload to maintain heading during low speed flight were a shortcoming. Three additional shortcomings were found during the evaluation. GRA

N88-14981# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugversuchstechnik.
DIGITAL PROCESSING OF FLIGHT TEST DATA WITHOUT USING ANTI-ALIASING FILTERS, USING A HELICOPTER AS AN EXAMPLE
Rainer Holland Jun. 1987 54 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-87-12; ISSN-0176-7739; ETN-88-91007) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 22.50

The possibility of sampling flight test data without using anti-aliasing filters was evaluated. Definitions and characteristics of digital filters, low pass filters, and choice of sampling frequency are treated. The noise level of the sensor signals onboard a helicopter is high due to the rotor vibrations. It is shown that digital filters are superior to analog filters for this application. After analog to digital conversion, the data are filtered in a digital computer. A smaller and more compact measuring setup can be realized if no anti-aliasing filters are used. The frequency characteristics of the digital filter can be varied within defined limits after the flight tests. Disadvantages are a larger number of data requiring more storage capacity, and a high calculation time. ESA

N88-14930*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF A FULL POTENTIAL METHOD FOR ANALYSIS OF COMPLEX AIRCRAFT GEOMETRIES
Kenneth M. Jones and Noel A. Talcott, Jr. *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 73-87
(For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

N88-14949*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NATURAL LAMINAR FLOW NACELLE FOR TRANSPORT AIRCRAFT
Milton Lamb, William K. Abeyounis, James C. Patterson, Jr., and Richard J. Re *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 445-460 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

N88-14951*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND EXPERIMENTAL EVALUATION OF A SWEPT SUPERCRITICAL LAMINAR FLOW CONTROL (LFC) AIRFOIL
W. D. Harvey, C. D. Harris, C. W. Brooks, P. G. Clukey, and J. P. Stack *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 475-484 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

N88-14954*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INSECT CONTAMINATION PROTECTION FOR LAMINAR FLOW SURFACES
Cynthia C. Croom and Bruce J. Holmes *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 539-556 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

N88-14955*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RIBLETS FOR AIRCRAFT SKIN-FRICTION REDUCTION
Michael J. Walsh *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 557-571 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

N88-14956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRFOIL LARGE EDDY BREAKUP DEVICES FOR TURBULENT DRAG REDUCTION
J. B. Anders *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 573-585 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N88-14982# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL DESIGN OF A PILOTED HELICOPTER OFF-AXIS-TRACKING SIMULATION USING A HELMET MOUNTED DISPLAY M.S. Thesis
Gerald J. Hopkins Sep. 1987 88 p
(AD-A186228) Avail: NTIS HC A05/MF A01 CSCL 17E

The development of target tracking weaponry on the Army's Advanced Attack Helicopter (AAH) allows directional tracking with FLIR imagery at large angles from the longitudinal axis. A flight simulation using a helmet mounted display was conducted to quantify head tracking performance and to identify off-axis tracking limits for the aircraft's Pilot Night Vision Sensor. The experimental parameters included varying flight trajectories (hover, rectilinear, and curvilinear paths) and the target velocities and ranges. This paper details the design efforts in creating tracking scenarios in the simulator and the head tracking algorithms used to generate command profiles for perfect line of sight tracking performance. Confidence in the algorithms for tracking data calculations was essential to experimental conclusions on human tracking behavior and performance. The successful attempt to replicate the night vision system of the AAH is also discussed. Author (GRA)

N88-14983# Naval Postgraduate School, Monterey, Calif.
AN AUTOPILOT DESIGN FOR THE UNITED STATES MARINE CORPS' AIRBORNE REMOTELY OPERATED DEVICE M.S. Thesis
Scot D. Lloyd Sep. 1987 166 p
(AD-A186379) Avail: NTIS HC A08/MF A01 CSCL 17G

An autopilot for the U.S. Marine Corps ducted fan hovercraft is designed using optimal control theory. Single input controllers are designed to govern the vehicle's roll rate and altitude rate. The gyroscopic coupling between the vehicle's pitch and yaw dynamics is examined and a multi-input controller is designed. A computer program called OPTCON is developed to generate optimal feedback control gains by solving the discrete matrix Riccati equation. This program is for the use on portable or home IBM compatible computers. Graphic plotting of the time-varying gains and of the systems time response is available for both monitor and hardcopy output. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N88-14984# Oak Ridge Gaseous Diffusion Plant, Tenn.
TURBINE ENGINE SUPPORTABILITY STUDY FOR ARMY AVIATION SYSTEMS COMMAND (AVSCOM)
30 Oct. 1987 50 p
(Contract DE-AC05-84OT-21400)
(DE88-002339; K/DSRD-1) Avail: NTIS HC A03/MF A01

This study attempts to assess the ability of the Army to support its gas turbine engine fleet which powers the US Army helicopter fleet. This task was composed of three elements: assessing the capabilities of commercial available sources, isolating the cost drivers, and investigating the entire spectrum of required support at all levels of maintenance. The study team was charged with making recommendations that would improve the effectiveness of logistic support while enhancing the mission readiness. The study centered on an intensive top-down examination of four options that exist within the worldwide gas turbine engine logistics arena. Those options are total contractor support, total in-house support, existing system, where the Army would utilize a mix of commercial contractors and government resources, and an enhanced current system, the recommended option of the study team, which utilizes a dual strategy for continued modernization; that is, increased reliance on the private sector in selected areas, as well as enhancements to the Army's existing systems. DOE

N88-14985*# United Technologies Corp., East Hartford, Conn.
FUEL-INJECTOR/AIR-SWIRL CHARACTERIZATION Final Report
J. B. McVey, J. B. Kennedy, and S. Russell Jan. 1988 58 p
(Contract NAS3-24352)
(NASA-CR-180864; NAS 1.26:180864) Avail: NTIS HC A04/MF A01 CSCL 21E

Experimental data on the characteristics of the spray produced by a gas-turbine engine airblast fuel injector are reported. The data acquired include the mass-flux distribution measured by use of a high-resolution spray patternator; the gas-phase velocity field measured by use of a two-component laser Doppler velocimeter, and the liquid droplet size and velocity distributions measured by use of a single-component phase-Doppler anemometer. The data are intended for use in assessments of two-phase flow computational methods as applied to combustor design procedures. Author

N88-14986# Beijing Inst. of Aeronautics and Astronautics (China).
DETERMINATION OF THE CRITICAL CRACK LENGTH a (SUB IC) IN TURBINE DISCS
J. Nie, Q. Hong, and C. Nie 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144812; ISTIC-TR-C-000044) Avail: NTIS HC E03/MF E01 CSCL 21E

In the design and analysis of the damage tolerance for turbine discs, it is necessary to determine exactly the critical crack length,

a sub IC. Using the cracks at the bottom fir tree slots of the first stage turbine disc in an existing engine as an example, by means of the breakdown test and an elaborate theoretical calculation, the criterion and the solution algorithm is presented to determine the critical crack length, a sub IC, and suggests that the condition under which the engine could not normally operate be regarded as the critical state for the crack. In view of the complexity of turbine disc shape and loading conditions, the J integral was employed in the elasto-plastic fracture mechanics and the twice evaluation algorithm for evaluation J integral which was proved to be a simpler and more accurate method than those presented in the literature. Author

N88-14936*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS AND PERFORMANCE PREDICTION OF SCRAMJET INLETS UTILIZING A THREE-DIMENSIONAL NAVIER-STOKES CODE
Ajay Kumar and Carl A. Trexler *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 187-208 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N88-14987*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HANDLING QUALITIES OF A WIDE-BODY TRANSPORT AIRPLANE UTILIZING PITCH ACTIVE CONTROL SYSTEMS (PACS) FOR RELAXED STATIC STABILITY APPLICATION
Wiliam D. Grantham, Lee H. Person, Jr., Philip W. Brown, Lawrence E. Becker, George E. Hunt, J. J. Rising, W. J. Davis, C. S. Willey, W. A. Weaver, and R. Cokeley Dec. 1985 109 p
(NASA-TP-2482; L-15928; NAS 1.60:2482) Avail: NTIS HC A06/MF A01 CSCL 01C

Piloted simulation studies have been conducted to evaluate the effectiveness of two pitch active control systems (PACS) on the flying qualities of a wide-body transport airplane when operating at negative static margins. These two pitch active control systems consisted of a simple 'near-term' PACS and a more complex 'advanced' PACS. Eight different flight conditions, representing the entire flight envelope, were evaluated with emphasis on the cruise flight conditions. These studies were made utilizing the Langley Visual/Motion Simulator (VMS) which has six degrees of freedom. The simulation tests indicated that (1) the flying qualities of the baseline aircraft (PACS off) for the cruise and other high-speed flight conditions were unacceptable at center-of-gravity positions aft of the neutral static stability point; (2) within the linear static stability flight envelope, the near-term PACS provided acceptable flying qualities for static stabilty margins to -3 percent; and (3) with the advanced PACS operative, the flying qualities were demonstrated to be good (satisfactory to very acceptable) for static stabilty margins to -20 percent. Author

N88-14988*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED HELICOPTER COCKPIT AND CONTROL CONFIGURATIONS FOR HELICOPTER COMBAT MISSIONS
Loran A. Haworth, Adolph Atencio, Jr., Courtland Bivens, Robert Shively, and Daniel Delgado Dec. 1987 18 p Presented at the 45th AGARD Guidance and Control Panel Symposium, 28 Sep. - 2 Oct. 1987, Stuttgart, Fed. Republic of Germany Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
(NASA-TM-100017; A-87315; NAS 1.15:100017; USAAVSCOM-TR-87-A-9) Avail: NTIS HC A03/MF A01 CSCL 01C

Two piloted simulations were conducted by the U.S. Army Aeroflightdynamics Directorate to evaluate workload and helicopter-handling qualities requirements for single pilot operation in a combat Nap-of-the-Earth environment. The single-pilot advanced cockpit engineering simulation (SPACES) investigations were performed on the NASA Ames Vertical Motion Simulator, using the Advanced Digital Optical Control System control laws and an advanced concepts glass cockpit. The first simulation (SPACES I) compared single pilot to dual crewmember operation for the same flight tasks to determine differences between dual and single ratings, and to discover which control laws enabled adequate single-pilot helicopter operation. The SPACES II simulation concentrated on single-pilot operations and use of control laws thought to be viable candidates for single pilot operations workload. Measures detected significant differences between single-pilot task segments. Control system configurations were task dependent, demonstrating a need for inflight reconfigurable control system to match the optimal control system with the required task. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N88-14989# Naval Postgraduate School, Monterey, Calif.
AN INEXPENSIVE REAL-TIME INTERACTIVE THREE DIMENSIONAL FLIGHT SIMULATION SYSTEM M.S. Thesis
Douglas B. Smith and Dale G. Streyle Jun. 1987 237 p
(AD-A184868) Avail: NTIS HC A11/MF A01 CSCL 05I

A prototype flight simulator for the Fiber-Optically Guided Missile (FOG-M) is presented. This prototype demonstrates the practicability and feasibility of using low-cost graphics hardware to produce acceptable simulation of flight over terrain generated from Defense Mapping Agency (DMA) digital elevation data. The flight simulator displays a dynamic, three-dimensional, out-the-window view of the terrain in real-time while responding to operator control inputs. The total system cost (software and hardware) of the simulator is an order of magnitude less than most flight simulation systems in current use. GRA

N88-14990# Computer Resource Management, Inc., Vienna, Va.
CHICAGO'S O'HARE RUNWAY CONFIGURATION MANAGEMENT SYSTEM (RCMS). VOLUME 1: DESCRIPTION OF THE OPERATIONAL SOFTWARE
Anthony Bradley, Helen Monk, and Edward Jaggard Jul. 1987 94 p
(Contract DTFA03-85-C-00046)
(AD-A185886; DOT/FAA/CT-86/15-1) Avail: NTIS HC A05/MF A01 CSCL 01E

Volume I of this report describes the proposed Runway Configuration Management System (RCMS) operational software for review by the facility personnel. It also serves as an input to RCMS functional specifications for the Traffic Management System (TMS) program. Using interactive computer logic, RCMS helps supervisors select runway configurations which reduce aircraft delays by optimizing throughput capacity in dynamic operational environments. Author (GRA)

N88-14991# Navy Personnel Research and Development Center, San Diego, Calif.
FIELD EVALUATION OF INTERACTIVE SIMULATION FOR MAINTENANCE TRAINING SH-3 HELICOPTER ELECTRO-MECHANICAL BLADEFOLD SYSTEM Technical Report, Nov. 1985 - Dec. 1986

Vernon M. Malec and Michael Luszczak Oct. 1987 35 p
(AD-A185923; AD-F000114; NPRDC-TR-88-2) Avail: NTIS HC A03/MF A01 CSCL 05I

This report describes an evaluation of the training effectiveness and suitability of an interactive simulation device and its instructional and simulation software used in connection with SH-3 helicopter electro-mechanical bladefold system training in the Naval Air Maintenance Training Group Detachment training environment. Although the study did not have sufficient subjects in all measurement categories for the application of statistical analysis methods, the results indicate that the training device is an effective supplement to both hydraulic and electrical systems training currently being performed on the SH-3 helicopter composite trainer. Trainees using the interactive training system required less time to complete troubleshooting exercises on the composite trainer, made fewer replacement errors, and obtained higher grades on written tests relating to the bladefold systems. GRA

N88-14992# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE ROLE OF ADAPTIVE SUPPLEMENTAL VISUAL CUING IN FLIGHT SIMULATION M.S. Thesis
Eddy R. Billman 1987 51 p
(AD-A185932; AD-F000114; AFIT/CI/NR-87-106T) Avail: NTIS HC A04/MF A01 CSCL 05I

The utility of adaptive visual cues for instructing an approach-to-landing task in a personal computer-based flight simulator was tested. Flight naive subjects in a control group trained with reference to a visual display that consisted of horizon, runway outline, runway centerline and touchdown aimpoint. Two experimental groups trained with glidepath and heading cues augmenting the display either constantly or adaptively. A simulator-to-simulator transfer-of-training design found no significant differences between instructional methods. Because other research had found adaptive cueing to be beneficial in transfer, implications of the differences in design considerations such as visual display field of view and the amount or content of subject pre-training is discussed and related to this study. GRA

N88-14993# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
COMPARATIVE STUDY OF NONDESTRUCTIVE PAVEMENT TESTING, MACDILL AIR FORCE BASE, FLORIDA Final Report, Aug. 1982 - Sep. 1983
Jim W. Hall, Jr Jul. 1987 270 p
(AD-A186082; WES/TR/GL-87-15) Avail: NTIS HC A12/MF A01 CSCL 13B

This project is the most comprehensive single undertaking to date which is directed toward an evaluation of the validity of concepts of nondestructive evaluation of the load-carrying capacity of airfield pavements. Seven nondestructive test devices tested five sections of airfield pavements at MacDill Air Force Base (AFB) which consisted of two rigid, two flexible, and one composite pavements, ranging from 20-in. portland cement concrete (PCC) to 5.5-in. asphaltic concrete. Analytical treatments of the test data included empirical correlation analyses, and layered-elastic and finite element computer analyses. Six private firms each with a different nondestructive testing (NDT) evaluation method provided evaluation results in terms of allowable aircraft loads and overlay thicknesses. The Air Force produced one set of results using its new nondestructive pavement testing method, and Waterways Experiment Station provided three sets of results. This study has shown that NDT technology exists for evaluation of airfield pavements. For the pavements at MacDill AFB, some NDT evaluation methods agreed better with the standard test-pit method than others. However, the pavements at MacDill AFB are rather nontypical, and those NDT evaluation methods that did not give good results at MacDill may give more agreeable results on different pavements. The lack of agreement between results of the NDT evaluation methods does justify concern and may point to the need for a standard evaluation method. GRA

N88-14994# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF THE ANALYSIS PHASE OF THE INSTRUCTIONAL SYSTEM DEVELOPMENT TO THE MK-105 MAGNETIC MINESWEEPING MISSION OF THE MH-53E HELICOPTER M.S. Thesis
David S. Broughton Sep. 1987 95 p
(AD-A186282) Avail: NTIS HC A05/MF A01 CSCL 15F

With the introduction of the MH-53E helicopter as a platform for airborne mine countermeasures, a new cockpit flight simulator was proposed. This simulator, device 2F141, will provide the U.S. Navy with the capability to simulate the flight environment of an airborne mine countermeasures mission. The method of the Instructional System Development (ISD) model was applied as a framework for development of a training program. This study concentrated on the analysis phase of the ISD process. Through the application of a task analysis and quantification methodology of the Mission Operability Assessment Technique (MOAT) a rank ordering of subtasks and major flight segments for the ship-based MK-105 magnetic minesweeping mission was determined. This study found that the major flight segments of landing, takeoff and preparation for tow, and transit to the minefield required the most improvement to increase the mission operability and effectiveness score. Therefore, a training program should be designed and developed that will effect these improvements by utilizing the cockpit flight simulator. GRA

N88-14995# Calspan Corp., Arnold AFS, Tenn.
STATIC FORCE AND MOMENT TEST OF THE HOLLOMAN NARROW-GAGE ROCKET SLED AT MACH NUMBERS FROM 3.5 TO 5.5 Final Report, 4-7 May 1987
C. L. Ratliff Sep. 1987 48 p Prepared in cooperation with AEDC, Arnold AFS, Tenn.
(AD-A186291; AEDC-TSR-87-V20) Avail: NTIS HC A03/MF A01 CSCL 14B

A static force and moment test was performed in the Supersonic Wind Tunnel A at Mach numbers from 3.5 to 5.5 to obtain experimental aerodynamic data on the 1/12th scale model of a Narrow-Gage Rocket Sled. The test was performed with the model in close proximity to a ground plane and rail assembly simulating the High Speed Test Track at Holloman Air Force Base. The configuration variables were the mounting of either a 4 or 16-degree wedge above the rocket motors. Final tabulation of test data results are included in this report. GRA

N88-14996*# National Bureau of Standards, Gaithersburg, Md. Center for Manufacturing Engineering.
WIND TUNNEL MODEL SURFACE GAUGE FOR MEASURING ROUGHNESS Final Report
T. V. Vorburger, D. E. Gilsinn, E. C. Teague, C. H. W. Giauque, F. E. Scire, and L. X. Cao Jun. 1987 57 p
(NASA Order L-4718-B; NASA Order L-20078-B)
(NASA-CR-182392; NAS 1.26:182392; PB88-109921; NBSIR-87/3586) Avail: NTIS HC A04/MF A01 CSCL 14B

The optical inspection of surface roughness research has proceeded along two different lines. First, research into a quantitative understanding of light scattering from metal surfaces and into the appropriate models to describe the surfaces themselves. Second, the development of a practical instrument for the measurement of rms roughness of high performance wind tunnel models with smooth finishes. The research is summarized, with emphasis on the second avenue of research. Author

N88-14937*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-DISTURBANCE WIND TUNNELS
I. E. Beckwith, Z. T. Applin, P. C. Stainback, and L. Maestrello *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 209-223 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

N88-14938*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND TUNNEL WALL INTERFERENCE
Perry A. Newman, Raymond E. Mineck, Richard W. Barnwell, and William B. Kemp, Jr. (College of William and Mary, Williamsburg, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 225-259 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

N88-14939*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS OF MAGNETIC SUSPENSION TECHNOLOGY
Richmond P. Boyden and Ping Tcheng *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 261-277 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

N88-14941*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY CALIBRATION AND TEST RESULTS FROM THE NATIONAL TRANSONIC FACILITY
Linwood W. McKinney and Dennis E. Fuller *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 311-331 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 14B

N88-14943*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WALL TURBULENCE CONTROL
Stephen P. Wilkinson, A. Margrethe Lindemann, George B. Beeler, Catherine B. McGinley, Wesley L. Goodman, and R. Balasubramanian *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 347-360 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N88-14997*# Texas Univ., Austin. Center for Space Research.
AN ORBIT SIMULATION STUDY OF A GEOPOTENTIAL RESEARCH MISSION INCLUDING SATELLITE-TO-SATELLITE TRACKING AND DISTURBANCE COMPENSATION SYSTEMS
Peter G. Antreasian Jan. 1988 119 p
(Grant NAG5-528)
(NASA-CR-182353; NAS 1.26:182353; CSR-88-1) Avail: NTIS HC A06/MF A01 CSCL 22A

Two orbit simulations, one representing the actual Geopotential Research Mission (GRM) orbit and the other representing the orbit estimated from orbit determination techniques, are presented. A computer algorithm was created to simulate GRM's drag compensation mechanism so the fuel expenditure and proof mass trajectories relative to the spacecraft centroid could be calculated for the mission. The results of the GRM DISCOS simulation demonstrated that the spacecraft can essentially be drag-free. The results showed that the centroid of the spacecraft can be controlled so that it will not deviate more than 1.0 mm in any direction from the centroid of the proof mass. B.G.

N88-14998*# Scripps Institution of Oceanography, La Jolla, Calif.
ERROR ASSESSMENTS OF WIDELY-USED ORBIT ERROR APPROXIMATIONS IN SATELLITE ALTIMETRY Final Technical Report
Chang-Kou Tai 3 Feb. 1988 9 p
(Grant NAGw-808)
(NASA-CR-182390; NAS 1.26:182390) Avail: NTIS HC A02/MF A01 CSCL 22A

From simulations, the orbit error can be assumed to be a slowly varying sine wave with a predominant wavelength comparable to the Earth's circumference. Thus, one can derive analytically the error committed in representing the orbit error along a segment of the satellite ground track by a bias; by a bias and tilt (linear approximation); or by a bias, tilt, and curvature (quadratic approximation). The result clearly agrees with what is obvious intuitively, i.e., (1) the fit is better with more parameters, and (2) as the length of the segment increases, the approximation gets worse. But more importantly, it provides a quantitative basis to evaluate the accuracy of past results and, in the future, to select the best approximation according to the required precision and the efficiency of various approximations. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

No abstracts in this category.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N88-14999*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SPACE TRANSPORTATION SYSTEM OPERATIONS MODEL
W. Douglas Morris and Nancy H. White Dec. 1987 65 p
(NASA-TM-100481; NAS 1.15:100481) Avail: NTIS HC A04/MF A01 CSCL 22B

Presented is a description of a computer program which permits assessment of the operational support requirements of space transportation systems functioning in both a ground- and space-based environment. The scenario depicted provides for the delivery of payloads from Earth to a space station and beyond

using upper stages based at the station. Model results are scenario dependent and rely on the input definitions of delivery requirements, task times, and available resources. Output is in terms of flight rate capabilities, resource requirements, and facility utilization. A general program description, program listing, input requirements, and sample output are included. Author

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N88-15000# Army Construction Engineering Research Lab., Champaign, Ill.

INVESTIGATION OF DESIGN CONCEPTS FOR LARGE SPACE STRUCTURES TO SUPPORT MILITARY APPLICATIONS Final Report

R. A. Eubanks and Alvin Smith Sep. 1987 34 p

(AD-A186098; CERL-TR-M-87/16) Avail: NTIS HC A03/MF A01 CSCL 22B

Future exploration and enterprise in low-Earth orbit will most likely require space stations for support. In addition, promotion of the Strategic Defense Initiative is mandating research and development into technologies for building structures to serve military objectives in space. However, an assessment of the state of the art for space construction technology has revealed that the field is immature, with little conceptual and experimental research completed. The U.S. Army Construction Engineering Research Laboratory (USA-CERL) has collected information on existing technologies for possible application in designing large space structures (LSS) for military support. This work is part of an effort to ensure mission-responsiveness in anticipation of a role in space construction. Military structures will require design criteria much different from those of experimental space stations. Proposed conceptual criteria for both types of structures are compared and differences are noted. Much R and D is needed before any of these structures can be developed in space. To serve as background for future studies, a literature critique is included in this report. GRA

N88-15001# WEA, Cambridge, Mass.

NATURAL FREQUENCIES AND STRUCTURAL INTEGRITY ASSESSMENT OF LARGE SPACE STRUCTURES Technical Report, 1 Sep. 1985 - 1 Apr. 1987

James H. Williams, Jr. and Raymond J. Nagem 1 Apr. 1987 39 p

(Contract F49620-85-C-0148)

(AD-A186139; AFOSR-87-1290TR) Avail: NTIS HC A03/MF A01 CSCL 20K

In a previous report, transfer matrices and joint coupling matrices are used to compute natural frequencies of vibration of a five-bay planar lattice structure. In this report, the problem of detecting damage in the five-bay planar lattice structure is considered. Seven different states of damage are assumed. Each damage state corresponds to a disconnected or partially disconnected joint in the lattice. Transfer matrices and joint coupling matrices are used to compute natural frequencies associated with each damage state. The natural frequencies computed for each damage state are significantly different from the natural frequencies of the undamaged lattice; for example, the frequencies of the first flexible mode of the damaged lattice are 26 to 83 percent lower than the frequency of the first flexible node of the undamaged lattice. The results presented here demonstrate that measurement of natural frequencies is a potentially useful method for detecting damage in lattice structures, at least, for the types of damage considered here. However, it is also shown here that measurement of natural frequencies alone is not sufficient, in general, to determine the location of damage within the lattice structure. Thus, measurement of natural frequencies should be regarded as only a part of a complete nondestructive evaluation method. After the results obtained here are presented, some suggestions for NDE methods which may be capable of providing more quantitative measures of structural integrity. GRA

N88-15002# WEA, Cambridge, Mass.

WAVE PROPAGATION EXPERIMENTS ON 22-BAY LATTICE Technical Report, 1 Sep. 1985 - 1 Jun. 1987

James H. Williams, Jr. and Jia J. Zhang 1 Jun. 1987 37 p

(Contract F49620-85-C-0148)

(AD-A186140; AFOSR-87-1289TR) Avail: NTIS HC A03/MF A01 CSCL 22B

Wave propagation characteristics of large space structures (LSS) affect their performance, integrity and the ability to nondestructively assess their integrity. In this study, wave propagation characteristics of an aluminum 22-bay planar lattice structure are determined experimentally. Two ultrasonic piezoceramic longitudinal transducers are mounted at various locations on the structure. Wave measurements are obtained by injecting an impulsive load via the transmitting transducer and recording the response via the receiving transducer. The waves injected into the structure are longitudinal waves, transverse to the surface, although a complex stress distribution which may be described by directivity functions is actually realized. The impulsive loading signal has a broad frequency spectrum containing frequencies greater than 0.5MHz. GRA

N88-15003# Harris Corp., Melbourne, Fla. Government Aerospace Systems Div.

MAXIMUM ENTROPY/OPTIMAL PROJECTION DESIGN SYNTHESIS FOR DECENTRALIZED CONTROL OF LARGE SPACE STRUCTURES Annual Report, Oct. 1986 - Apr. 1987

David C. Hyland and Dennis S. Bernstein May 1987 233 p

(Contract F49620-86-C-0038)

(AD-A186359; AFOSR-87-1196TR) Avail: NTIS HC A11/MF A01 CSCL 22A

The Maximum Entropy/Optical Projection (MEOP) methodology is a novel approach to designing implementable vibration-suppression controllers for large space systems. Two issues, in particular, have been addressed, namely, controller order (i.e., complexity) and systems robustness (i.e., sensitivity to plant variations). Extensions developed herein include generalizations to decentralized controller architectures and a new robustness analysis technique known as Majorant Robustness Analysis. GRA

N88-15004# LABEN Space Instrumentation and Systems, Milan (Italy).

EXPERT SYSTEM STUDY FOR SPACECRAFT MANAGEMENT Final Report

P. Donzelli, B. AnkerMoeller, B. Soerensen, and R. Katzenbeisser (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) Feb. 1987 110 p

(Contract ESA-6029/84)

(TL-2699-Iss-1; ESA-CR(P)-2445; ETN-88-91142) Avail: NTIS HC A06/MF A01

The feasibility with state of the art technology of an on-board expert system for management of an autonomous spacecraft was assessed. Requirements for the design, development and test of the expert system were specified. Fault management functions were selected and knowledge about them was detailed for power and on-board data handling. The definition of such domain knowledge was supported by a knowledge specification formalism proposed by the knowledge engineers to the domain experts for the preliminary acquisition of all the information considered useful and necessary for the creation of the knowledge base. The development environment, and approaches for the testing, evaluation and validation of the prototype fault management system were studied. The impact of the use of on-board expert systems on ground/spacecraft communication protocols and on board complexity was assessed. ESA

N88-15005# Aeritalia S.p.A., Naples (Italy). Space Systems Group.
COLUMBUS PRESSURIZED MODULE UTILIZATION STUDY, EXECUTIVE SUMMARY Final Report
R. Bate and M. Merlo Paris, France ESA 12 Jun. 1987 30 p
(CS-RP-AI-027; ESA-CR(P)-2460; ETN-88-91154) Avail: NTIS HC A03/MF A01

The optimum way to exploit the Columbus laboratories capabilities was defined by identifying and describing payload accommodation, integration, operations, mission planning, user support, and mission assurance and safety. A detailed plan for mission implementation was produced and preliminary associated costs were estimated. The payload and utilization derived requirements for both the overall Columbus system and its two pressurized modules were specified. ESA

N88-15608*# Morehouse Coll., Atlanta, Ga. Dept. of Mathematics.
INVESTIGATION OF THE FEASIBILITY OF AN ANALYTICAL METHOD OF ACCOUNTING FOR THE EFFECTS OF ATMOSPHERIC DRAG ON SATELLITE MOTION
Robert E. Bozeman *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 27 p (For primary document see Summer Faculty Fellowship Program 27 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 22B

N88-15631*# Tri-State Univ., Angola, Ind. Dept. of Mechanical and Aerospace Engineering.
TETHER ELEVATOR CRAWLER SYSTEMS (TECS)
Frank R. Swenson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 23 p (For primary document see Summer Faculty Fellowship Program 23 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N88-15006*# Martin Marietta Aerospace, Denver, Colo.
SPACE STATION ONBOARD PROPULSION SYSTEM: TECHNOLOGY STUDY Final Report
J. G. McAllister, R. S. Rudland, L. R. Redd, D. H. Beekman, S. M. Cuffin, C. M. Beer, and K. K. McCarthy Jan. 1987 106 p
(Contract NAS3-23893)
(NASA-CR-179233; NAS 1.26:179233; MCR-87-500) Avail: NTIS HC A06/MF A01 CSCL 21H

The objective was to prepare for the design of the space station propulsion system. Propulsion system concepts were defined and schematics were developed for the most viable concepts. A dual model bipropellant system was found to deliver the largest amount of payload. However, when resupply is considered, an electrolysis system with 10 percent accumulators requires less resupply propellant, though it is penalized by the amount of time required to fill the accumulators and the power requirements for the electrolyzer. A computer simulation was prepared, which was originally intended to simulate the water electrolysis propulsion system but which was expanded to model other types of systems such as cold gas, monopropellant and bipropellant storable systems. J.P.B.

N88-15007# R and D Associates, Alexandria, Va. Research Lab.
UNIFIED STUDY OF PLASMA-SURFACE INTERACTIONS FOR SPACE POWER AND PROPULSION Final Technical Report, 1 Nov. 1985 - 31 Jul. 1986
Peter Turchi 14 Jul. 1987 37 p
(Contract F49620-85-C-0011)
(AD-A186211; RDA-TR-133700-002; AFOSR-87-1311TR) Avail: NTIS HC A03/MF A01 CSCL 21C

The interaction of a high speed (10-20 km/sec) plasma flow of modest temperature (0.5-5 eV) with a solid surface is a basic phenomenon in a variety of high specific power devices, such as advanced high specific impulse thrusters. Study of the details of processes involved in the immediate vicinity of the surface is normally precluded by the very limited diagnostic access afforded in mission-oriented devices. The present research program establishes a plasma flow by means of a quasi-steady magnetoplasmadynamic arcjet and exposes simple solid surfaces to this flow while examining the plasma surface interaction spectroscopically. Detailed measurements provide the benchmark for theoretical modeling that may then be applied to the more complex geometries of actual plasmadynamic devices. The present report covers the development and characterization of the arcjet plasma source and the initial results from experimental diagnostics focused near the surface of a dielectric blunt body in a high speed argon flow. GRA

N88-15616*# LeTourneau Coll., Longview, Tex. Dept. of Natural Science.
EQUILIBRIUM RETENTION IN THE NOZZLE OF OXYGEN HYDROGEN PROPULSION SYSTEMS
D. I. Ford *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 26 p (For primary document see Summer Faculty Fellowship Program 26 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 21H

N88-15632*# Alabama A & M Univ., Huntsville. Dept. of Mathematics.
PROPULSION ESTIMATION TECHNIQUES
Enoch C. Temple *In* NASA. Marshall Space Flight Center,

Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 14 p (For primary document see Summer Faculty Fellowship Program 14 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N88-15008# Michigan State Univ., East Lansing.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF MECHANICALLY FASTENED COMPOSITES Final Technical Report, May 1985 - Dec. 1986
Gary Cloud, David Sikarskie, Pedro H. Franco, and Micahel Bayer Feb. 1987 376 p
(Contract DAAE07-85-C-R037; DA Proj. 1L1-62601-AH-91)
(AD-A185896; TACOM-TR-12844) Avail: NTIS HC A17/MF A01 CSCL 11D

The contractors conducted an experimental and analytical study of the mechanics of fasteners in GFRP (glass fiber reinforced epoxy) composites. Areas of study considered in the contract included multiple-fastener arrays, load spreading washers of three types, bolt preload effects, field measurement, developement of analytical and experimental methods, parametric studies, and creation of design codes. A comprehensive study of literature pertaining to methods of mechanically fastening composites was undertaken, and a summary survey is included herein. Experimental methods consisted primarily of high-sensitivity, three-axis moire interferometry with digital data acquisition and data reduction. The appropriate apparatus and procedures were established as part of the contract effort. Analytical methods centered upon the boundary element approach. Algorithms and codes which yield stress strain fields for anisotropic materials in multiply connected geometries were created. A bolt load transducer was developed for determining joint loads in the field. Resistance strain gages were used to verify in plane strains measured by moire methods. Poorly fitted pins or tilted pins effect strain field drastically. Strain gage results were between the ideal case and the tilted-pin strain readings. Stress concentrations were reduced by judicious use of fastener arrays and conical washers with high bolt tension. GRA

N88-15009# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INTERFACE EFFECTS ON THE MECHANICAL PROPERTIES OF CERAMIC COMPOSITES Annual Report No. 2, 15 Jul. 1986 - 14 Jul. 1987
D. B. Marshall Sep. 1987 78 p
(Contract N00014-85-C-0416)
(AD-A185899; SC5432.AR) Avail: NTIS HC A05/MF A01 CSCL 11B

Macroscopic and microscopic mechanical properties of ceramic composites have been investigated. A fracture mechanics analysis was developed to evaluate the influence of residual microstructural stresses on the fracture toughness of composites that are reinforced by crack bridging mechanisms. The magnitude and sign of the toughening were found to be very sensitive to the details of the bridging mechanism and the criterion for ligament rupture. These results highlight the need for techniques to measure microscopic mechanical properties such as residual stresses, interfacial debonding and sliding resistance, and deformation and fracture of small reinforcements. Further analysis of an indentation fiber pushing technique that was developed previously under this contract for measuring fiber-matrix interfacial properties has enabled the technique to be used to measure residual stresses in individual fibers and to measure frictional sliding resistance in carbon fiber composites. GRA

N88-15010# Naval Postgraduate School, Monterey, Calif.
COMPOSITE RELIABILITY ENHANCEMENT VIA PRELOADING M.S. Thesis
David K. Bell Jun. 1987 98 p
(AD-A185938; AD-F000114) Avail: NTIS HC A05/MF A01 CSCL 11D

Many Navy applications of composites, including ships' superstructures, submarine air flasks and missile rocket motor casings, require high strength and reliable materials. Composite strength reliability is dictated by individual fiber breaks at low loads (lower tail) and the accumulation of the fiber failure sites. This study examined the effects of applying a preload to a graphite epoxy composite tow prior to complete polymerization of the matrix. The objective was to break the (inevitable) weak fibers and minimize the effects of the associated stress concentrations, subsequently limiting the clustering of the fiber failures. By eliminating the lower tail, the shape of the Weibull distribution is reduced, thereby enhancing composite reliability. GRA

N88-15011# Michigan Univ., Ann Arbor. Coll. of Engineering.
INTERFACIAL SHEAR STRENGTH OF PITCH AND HIGH STRAIN PAN FIBERS IN AN EPOXY MATRIX Final Technical Report
T. Gendron, M. Waterbury, and L. T. Drzal 1987 33 p
(Contract N00014-86-K-0393)
(AD-A185966; AD-F000114) Avail: NTIS HC A03/MF A01 CSCL 11D

In advanced polymeric composites reinforced with fibers of glass, carbon, or graphite the ability to effectively use the strength and stiffness of these reinforcing fiber depends on properties of the matrix material and the degree of bounding between fiber and matrix. This work uses the embedded fiber method to directly determine the interfacial shear strength between 1) pan high strain carbon fibers with different surface modifications and 2) mesophase pitch based carbon fibers of various moduli and surface modifications with an epoxy matrix. The effect of the various surface modifications on the interfacial shear strength was evaluated in an attempt to determine their interrelationships. The results show that sizing of the fiber increases the interfacial shear strength by 23% over an unsized fiber while an oxidative surface treatment produces an increase of over 200% over the untreated PAN carbon fiber. The mesophase pitch based fibers showed a general decrease in the interfacial shear strength with an increasing fiber modulus. GRA

N88-15012# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
CHARACTERIZATION OF MICROSTRUCTURE IN METALLIC AND COMPOSITE MATERIALS Final Report, 15 Dec. 1984 - 14 Dec. 1985
A. Lawley Aug. 1987 4 p
(Grant AF-AFOSR-0045-85)
(AD-A186193; AFOSR-87-1328TR) Avail: NTIS HC A02/MF A01 CSCL 11D

Drexel University's Department of Materials Engineering has acquired a state of the art optical metallograph and an image analysis system. The latter interfaces with the optical metallograph and a scanning electron microscope. The optical analysis system (Model DV-4400) for interfacing with the Zeiss Metallograph is designed to perform image enhancement, feature measurement and classification, utilizing a conventional TV camera. Interfacing with the scanning electron microscope, allows the operator to perform quantitative image analysis directly from the specimen in

the microscope. In addition, the unit can determine relative x-ray intensity classification on the basis of chemistry. GRA

N88-15013# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
MACROSCOPIC DISTRIBUTION OF FIBER FINISH [REPARTITION MACROSCOPIQUE DE L'ENSIMAGE DE FIBRES]
J. Odorico and Y. Henry 24 Feb. 1987 58 p In FRENCH
(Contract DRET-85-34-489)
(DCQ/L-48-283/F; ETN-88-90902) Avail: NTIS HC A04/MF A01

The uniformity of finish distribution in carbon fibers used in the manufacturing of aerospace structures is studied. A chemical and an optical method were developed. The second is based on the measurement of transmitted infrared radiation; it is fast and easy to implement, but the information is limited to overall data and slow scrolling. It is found that the two methods are complementary, and if used simultaneously allow an easy detection of finish-deficient zones, and a reasonable measure of the distribution of finish. ESA

N88-15014*# Boeing Commercial Airplane Co., Seattle, Wash.
STUDY ON UTILIZATION OF ADVANCED COMPOSITES IN FUSELAGE STRUCTURES OF LARGE TRANSPORTS Final Report
R. W. Johnson, L. W. Thomson, and R. D. Wilson Feb. 1985 144 p
(Contract NAS1-17417)
(NASA-CR-172406; NAS 1.26:172406) Avail: NTIS HC A07/MF A01 CSCL 11D

The potential for utilizing advanced composites in fuselage structures of large transports was assessed. Six fuselage design concepts were selected and evaluated in terms of structural performance, weight, and manufacturing development and costs. Two concepts were selected that merit further consideration for composite fuselage application. These concepts are: (1) a full depth honeycomb design with no stringers, and (2) an I section stringer stiffened laminate skin design. Weight reductions due to applying composites to the fuselages of commercial and military transports were calculated. The benefits of applying composites to a fleet of military transports were determined. Significant technology issues pertinent to composite fuselage structures were identified and evaluated. Program plans for resolving the technology issues were developed. Author

N88-15015*# Texas Univ., El Paso. Dept. of Metallurgical Engineering.
IMPACT OF SOLIDS ON COMPOSITE MATERIALS Final Report, 1 Sep. 1986 - 31 Aug. 1987
Arturo Bronson, Jerry Maldonado, Tzong Chern, Francisco Martinez, Johnnie McCord-Medrano, and Paul N. Roschke (Texas A&M Univ., College Station.) 20 Dec. 1987 83 p
(Grant NAG9-175)
(NASA-CR-182395; NAS 1.26:182395) Avail: NTIS HC A05/MF A01 CSCL 11D

The failure modes of composite materials as a result of low velocity impact were investigated by simulating the impact with a finite element analysis. An important facet of the project is the modeling of the impact of a solid onto cylindrical shells composed of composite materials. The model under development will simulate the delamination sustained when a composite material encounters impact from another rigid body. The computer equipment was installed, the computer network tested, and a finite element method model was developed to compare results with known experimental data. The model simulated the impact of a steel rod onto a rotating shaft. Pre-processing programs (GMESH and TANVEL) were developed to generate node and element data for the input into the three dimensional, dynamic finite element analysis code (DYNA3D). The finite element mesh was configured with a fine mesh near the impact zone and a coarser mesh for the impacting rod and the regions surrounding the impacting zone. For the computer simulation, five impacting loads were used to determine the time history of the stresses, the scribed surface areas, and the amount of ridging. The processing time of the computer codes amounted from 1 to 4 days. The calculated surface area were within 6-12 percent, relative error when compated to the actual scratch area. Author

N88-15016# Institute of Aeronautical Materials, Beijing (China).
INVESTIGATIONS ON THE CRACK GROWTH RETARDATION BEHAVIOR AND FATIGUE LIFE PREDICTION IN STRUCTURAL MATERIALS
M. Yan and M. Gu 1986 14 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143756; ISTIC-TR-C-000050) Avail: NTIS HC E03/MF E01 CSCL 11D

A brief survey over some recent investigations on crack growth retardation behavior and fatigue life prediction by several semi-empirical models and their modifications is presented. The Wheeler, Willenborg, Matsuoka and Maarse models were chosen for evaluating the ability to predict the fatigue life in a Ti-6Al-4V alloy. Modifications of the Willenborg and Maarse models and their application to life prediction under single or a series of tensile overloads and spectrum loading were described. The mechanism of fatigue crack growth retardation behaviors under tensile overloading was discussed. GRA

N88-15017# Royal Naval Engineering Coll., Manadon (England). Plymouth Composite Materials Research Group.
BIBLIOGRAPHY OF TEXTBOOKS ON FIBRE REINFORCED PLASTICS (212 BOOKS)
J. Summerscales and D. Short 13 Dec. 1986 18 p
(PB87-146080; PCMRG-BIB-012) Avail: NTIS HC E04/MF E04 CSCL 11D

This bibliography of textbooks is arranged by alphabetical sequence of the author/editor surnames, with chronological subdivision within groups of common surnames. Conference proceedings and establishment reports are specifically excluded. The list is intended to be comprehensive but errors and omissions are inevitable, especially for very recent or long out-of-print publications or for foreign language books. A sequence of bibliographies on fiber reinforced polymers and on rubbers and elastomers was prepared by J. Summerscales of the Royal Naval Engineering College and D. Short of the Plymouth Polytechnic. All of these (except PCMRG-BIB-009 and 010) were submitted to the US National Technical Information Service through whom copies can be obtained. GRA

N88-15018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVING THE INTERLAMINAR SHEAR STRENGTH OF CARBON FIBER-EPOXY COMPOSITES THROUGH CARBON FIBER BROMINATION
Donald A. Jaworske and Carolyn Maciag (Cleveland State Univ., Ohio.) Dec. 1987 11 p
(NASA-TM-100248; E-3870; NAS 1.15:100248) Avail: NTIS HC A03/MF A01 CSCL 11D

The use of bromine to improve the interlaminar shear strength of PAN-based carbon fibers was investigated. Composite test specimens fabicated from brominated T-300 fibers and a MY720 matrix exhibited on average a 30% improvement in ILSS over their pristine counterparts. Mass, electrical resistivity, density, contact angle, and scanning Auger microscopy results suggested a mechanism in which the bromine was covalently bonded to the surface of the fiber, and this resulted in an increased van der Waal's adhesion between fiber and matrix. Author

N88-15019# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
EFFECT OF POINT DEFECTS ON GRAPHITE LATTICE PARAMETERS
V. A. Nikolaenko and P. A. Platonov 1986 16 p In RUSSIAN
(DE88-700340; IAE-4240/11) Avail: NTIS (US Sales Only) HC A03/MF A01

Contributions of interstitial atoms and vacancies into graphite lattice parameter change along c and a axes are calculated on the basis on the binding order model (dependence of the carbon interatomic distance on the binding order is used). The contribution into graphite lattice parameter change from the aggregate of interstitial atoms: binary, ternary and larger ones up to extraplanes, is determined on the basis of the same model. The c/c : a/a ratio for irradiated graphite depending on the radiation and annealing temperature is analysed. Quantitatively calculated values of this ratio for the definite defects agree with the experiment. DOE

N88-15020*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED PROCEDURES FOR DESIGNING COMPOSITE BOLTED JOINTS
Christos C. Chamis Feb. 1988 15 p Prepared for the 43rd Annual Conference of the Society o the Plastics Industry, Cincinnati, Ohio, 1-5 Feb. 1988
(NASA-TM-100281; E-3922; NAS 1.15:100281) Avail: NTIS HC A03/MF A01 CSCL 11D

Simplified procedures are described to design and analyze single and multi-bolt composite joints. Numerical examples illustrate the use of these methods. Factors affecting composite bolted joints are summarized. References are cited where more detailed discussion is presented on specific aspects of composite bolted joints. Design variables associated with these joints are summarized in the appendix. Author

N88-15607*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
INVESTIGATION OF LOW VELOCITY IMPACT DAMAGE ON FILAMENTARY COMPOSITE MATERIALS
Mark V. Bower *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 24 p (For primary document see Summer Faculty Fellowship Program 24 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N88-15021*# Princeton Univ., N. J. Dept. of Chemical Engineering.
MATHEMATICAL MODELS OF CONTINUOUS FLOW ELECTROPHORESIS: ELECTROPHORESIS TECHNOLOGY Final Report, Aug. 1977 - Sep. 1986
Dudley A. Saville Dec. 1986 19 p
(Contract NAS8-32614)
(NASA-CR-179241; NAS 1.26:179241) Avail: NTIS HC A03/MF A01 CSCL 07D

Two aspects of continuous flow electrophoresis were studied: (1) the structure of the flow field in continuous flow devices; and (2) the electrokinetic properties of suspended particles relevant to electrophoretic separations. Mathematical models were developed to describe flow structure and stability, with particular emphasis on effects due to buoyancy. To describe the fractionation of an arbitrary particulate sample by continuous flow electrophoresis, a general mathematical model was constructed. In this model, chamber dimensions, field strength, buffer composition, and other design variables can be altered at will to study their effects on resolution and throughput. All these mathematical models were implemented on a digital computer and the codes are available for general use. Experimental and theoretical work with particulate samples probed how particle mobility is related to buffer composition. It was found that ions on the surface of small particles are mobile, contrary to the widely accepted view. This influences particle mobility and suspension conductivity. A novel technique was used to measure the mobility of particles in concentrated suspensions. Author

N88-15022# Office of Naval Research, London (England).
EUROPEAN REACTING FLOW RESEARCH: A FINAL ASSESSMENT
Eugene F. Brown 3 Sep. 1987 12 p
(AD-A185833; ONRL-7-027-R) Avail: NTIS HC A03/MF A01 CSCL 21B

A sampling of combustion research activities in Europe is provided, with emphasis on the work in France, West Germany, and the United Kingdom. There is a great deal of diversity in the projects, and in most cases there is strong industrial support. Important new European initiatives are reported, i.e., the European Communities Combustion Research Program and the European Center on Flow, Turbulence, and Combustion Simulation. GRA

N88-15023# Florida Univ., Gainesville. Dept. of Chemistry.
DEVELOPMENT OF FTMS METHODS FOR THE DETECTION OF TRACE CHEMICAL SPECIES AND DEVELOPMENT OF FTMS METHODS FOR THE ANALYSIS OF VARIOUS CHEMICAL SPECIES Final Report, Jul. 1982 - Jun. 1987
John R. Eyler 29 Sep. 1987 3 p
(Contract N00014-82-K-0509)
(AD-A185857) Avail: NTIS HC A02/MF A01 CSCL 07D

The techniques of Fourier Transform Ion Cyclotron Resonance (FTICR) Mass Spectrometry have been developed and extended to the analysis of various chemical species, including organometallics and energetic materials such as nitramines. Laser photodissociation has been shown valuable in differentiating isomeric ion structures, and laser desorption has been demonstrated to be a useful tool in the formation of ions from both large organic and bio-molecules and metal clusters. GRA

N88-15024# State Univ. of New York, Buffalo. Dept. of Chemistry.
FUNDAMENTAL STUDIES OF SURFACES PROCESSES AND TRACE ANALYSIS USING SOLID ELECTRODES Final Technical Report, 1 Oct. 1983 - 31 Dec. 1986
Stanley Bruckenstein 10 Aug. 1987 17 p
(Grant AF-AFOSR-0004-83)
(AD-A186156; AFOSR-87-1027TR) Avail: NTIS HC A03/MF A01 CSCL 07D

The objective of the work carried out under this grant was to perform physical electrochemical and electroanalytical studies at various kinds of solid electrodes. The physical electrochemical investigations were divided into studies of heterogeneous electrode kinetics, underpotential deposition and electrocatalysis. The electroanalytical work areas involved trace analysis of solutions using hydrodynamic voltammetry and of solutions and gases using porous electrode structures. Novel porous electrode techniques were developed for the analysis of trace species present in both liquid and gas phases. Two novel and simple electronic circuits were developed for electrochemical applications. GRA

N88-15025# General Electric Co., Schenectady, N.Y. Research and Development Center.
CARBON MONOXIDE AND TURBULENCE-CHEMISTRY INTERACTIONS: BLOWOFF AND EXTINCTION OF TURBULENT DIFFUSION FLAMES Annual Report, 1 Jun. 1986 - 1 May 1987
S. M. Correa and A. Gulati 31 May 1987 77 p
(Contract F49620-85-C-0035)
(AD-A186276; AFOSR-87-1162TR) Avail: NTIS HC A05/MF A01 CSCL 07D

The goal of this program is to understand turbulence chemistry interactions in combustion up to and including localized extinction. Experimentally, pilot stabilized non premixed turbulent jet flames of selected mixtures are being studied under conditions conducive to strain-induced local extinction. Laser based techniques such as Raman scattering and Rayleigh scattering are employed. Analytically, models based on the asymptotically thin flamelet concept and on distributed reaction zone concepts are being

assessed. A significant finding is that the popular contemporary view of a turbulent flame as an ensemble of asymptotically thin flamelets seems incorrect. Alternative mechanisms based on thick flamelets are proposed. The results include: (1) A complete reevaluation of Raman data showing significant corrections due to high temperature effects. GRA

N88-15026# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF FUEL ADDITIVE EFFECTS ON SOOTING FLAMES Annual Report
Paul A. Bonczyk 30 Jun. 1987 14 p
(Contract F49620-86-C-0054)
(AD-A186403; UTRC/R87-957464-A; AFOSR-87-1283TR) Avail: NTIS HC A03/MF A01 CSCL 21B

The objective of this research is to clarify the mechanisms responsible for the suppression of soot in flames by fuel additives. Measurements are limited to well-defined hydrocarbon/air prevaporized liquid- and gaseous-fueled flames. Emphasis is given to ferrocene in a diffusion flame fueled by prevaporized iso-octane. Nonperturbing laser/optical diagnostic techniques are used to relate changes in soot particulate size, number density, and volume fraction to additive concentration. Ferrocene is observed to suppress a visible soot plume completely and, in general, to intervene at a late combustion stage. Suppression is due to both size and number density reduction, which suggests that ferrocene enhances the oxidative burn-out of soot. In contrast, at an early combustion stage nearer the burner lip, a slight enhancement of soot is observed with ferrocene seeding. GRA

N88-15027*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CELLULAR SOLIDIFICATION IN A MONOTECTIC SYSTEM Center Director's Discretionary Fund Final Report
W. F. Kaukler and P. A. Curreri Dec. 1987 45 p
(NASA-TM-100317; NAS 1.15:100317) Avail: NTIS HC A03/MF A01 CSCL 07D

Succinonitrile-glycerol, SN-G, transparent organic monotectic alloy is studied with particular attention to cellular growth. The phase diagram is determined, near the monotectic composition, with greater accuracy than previous studies. A solidification interface stability diagram is determined for planar growth. The planar-to-cellular transition is compared to predictions from the Burton, Primm, Schlichter theory. A new technique to determine the solute segregation by Fourier transform infrared spectroscopy is developed. Proposed models that involve the cellular interface for alignment of monotectic second-phase spheres or rods are compared with observations. Author

N88-15028# Yale Univ., New Haven, Conn.
CATALYTIC COMBUSTION OF METHANE Annual Report, 15 May 1986 - 15 May 1987
L. D. Pfefferle and M. D. Smooke May 1987 49 p
(Contract GRI-5086-260-1249)
(PB88-123112; GRI-87/0235) Avail: NTIS HC A03/MF A01 CSCL 21B

The first year of a three year experiment and modeling effort to characterize surface species and catalytic pathways to the catalytically stabilized combustion of natural gas resulted in the measurement of hydroxyl and atomic oxygen radicals in a reacting boundary layer over catalytic and noncatalytic plates. Laser induced fluorescence was employed to obtain spatially resolve concentration profiles of OH and O atoms in the boundary layer. Stability data were also obtained for mixtures of methane and ethane in a catalytically stabilized burner. A fully adaptive nonlinear parabolic partial differential equation was developed and applied in the validation of the detailed transport/finite rate chemistry boundary layer model. Author

N88-15029# Colorado Univ., Boulder.
STUDIES OF METAL/CARBON SURFACE CHEMISTRY Research Report, 1 Dec. 1986 - 28 Feb. 1987
B. E. Koel 30 Mar. 1987 5 p
(Contract DE-FG22-84PC-70779)
(DE87-009545; DOE/PC-70779/13) Avail: NTIS HC A02/MF A01

Work on obtaining vibrational spectra of potassium compounds on Pt(111) and graphite-covered Pt(111) surfaces is continuing. In addition, experiments have been carried out on Pd(111) and graphite-covered Pd(111) surfaces. Preliminary evidence indicates that energy loss spectroscopy (ELS), done at higher energies of about 120 eV which excites electronic transitions, can provide additional fingerprint information that can be used for identification of the chemical nature of alkali compounds, e.g., oxides, hydroxides, and carbonates. Therefore, benchmark experiments have been initiated which explore this sensitivity further. Pure pellets of KO2, KBr, and K2CO3 were pressed on Pt foil and mounted on the transfer rod for introduction into the uhv changer. AES, XPS, and ELS studies were performed on these samples. KO2 gave a lot of structure in the ELS spectrum which indicates the sensitivity of the technique. KBr and K2CO2 gave similar ELS spectra, possibly indicating oxidation of the KBr, or contamination of both samples. More stringent loading techniques are being developed. DOE

N88-15030# Lawrence Livermore National Lab., Calif.
HYDROGEN RETENTION AND RELEASE FROM URANIUM DIOXIDE Ph.D. Thesis
D. F. Sherman Aug. 1987 158 p
(Contract DE-AC03-76SF-00098)
(DE88-002042; LBL-24030) Avail: NTIS HC A08/MF A01

Ceramic samples (UO2) are exposed to high pressure hydrogen gas at a fixed temperature for a time sufficient to achieve equilibrium. After rapid quenching, the hydrogen-saturated sample is transferred to a vacuum-outgassing furnace, where it is outgassed in a linear temperature ramp and the released hydrogen detected by an in-situ mass spectrometer. This technique measures the rate of release of hydrogen with a sensitivity level of about 2 ng of hydrogen (as D2) per hour. Experiments were conducted on both polycrystalline and single-crystal UO2. Experimental variables included temperature (1000 to 1600 C) and infusion pressure (5 to 32 atm D2), and for the polycrystalline specimen, stoichiometry. Dissolution of H2 in both single-crystal and polycrystalline UO2 was found to obey Seivert's law. The Sievert's law constant of deuterium in single-crystal UO2 was determined to be: 3.0 x 10 to the 7th exp(-235 kJ/RT) ppM atomic/ sq rt atm and for polycrystalline UO2: 5.5 x 10 to the 4th exp(-100 kJ/RT) ppM atomic/ sq rt atm. The solubility of hydrogen in hypostoichiometric urania was found to be up to three orders of magnitude greater than in stoichiometric UO2 depending on the O/U ratios -- this implying the anion vacancy is the primary solution site in the UO2 lattice. The release-rate curves for the single crystal and polycrystalline UO2 specimens exhibited multiple peaks, with most of the deuterium released between 600 and 1200 C for the polycrystalline samples, and between 700 and 1800 C in the single-crystal specimens. This release of hydrogen from UO2 could not be adequately modeled as diffusion or diffusion with trapping and resolution. It was determined that release was governed by release from traps in both the polycrystalline and single crystal UO2 specimens. DOE

N88-15031# Sandia National Labs., Albuquerque, N. Mex.
THE ROLE OF LOW TEMPERATURE CHEMISTRY IN THE AUTOIGNITION OF N-BUTANE
R. M. Green, N. P. Cernansky, W. J. Pitz, and C. K. Westbrook 1987 19 p Presented at the International Fuels and Lubricants Meeting and Exposition, Toronto, Ontario, 2 Nov. 1987 Sponsored in part by DOE Prepared in cooperation with Drexel Univ., Philadelphia, Pa. and Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE88-002385; UCRL-97547; CONF-871142-3) Avail: NTIS HC A03/MF A01

The chemical aspects of the compression ignition of n-butane is studied experimentally in a spark ignition engine and theoretically using computer simulations with a detailed chemical kinetic mechanism. The results of these studies demonstrate the effect of initial charge composition on autoignition. Experimentally, when

the initial charge consisted of 80 percent fresh charge and 20 percent recycled products of combustion, it was observed that autoignition was inhibited. On the other hand, charging with 80 percent fresh charge and 20 percent partial oxidation products from the previous motored cycle resulted in enhanced low-temperature chemistry (with the associated heat release and temperature increase) and autoignition. How well the detailed kinetic model could predict the autoignition was assessed and the model modified to better simulate the experimental observations. How chemical preconditioning of the fuel-air charge affected the autoignition process was also assessed. DOE

N88-15032*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
SRB COMBUSTION DYNAMICS ANALYSIS COMPUTER PROGRAM (CDA-1) Final Report
T. J. Chung and O. Y. Park Feb. 1988 130 p
(Grant NAG8-627)
(NASA-CR-182404; NAS 1.26:182404) Avail: NTIS HC A07/MF A01 CSCL 21B

A two-dimensional numerical model is developed for the unsteady oscillatory combustion of the solid propellant flame zone. Variations of pressure with low and high frequency responses across the long flame, such as in the double-base propellants, are accommodated. The formulation is based on a premixed, laminar flame with a one-step overall chemical reaction and the Arrhenius law of decomposition for the gaseous phase with no condensed phase reaction. Numerical calculations are carried out using the Galerkin finite elements, with perturbations expanded to the zeroth, first, and second orders. The numerical results indicate that amplification of oscillatory motions does indeed prevail in high frequency regions. For the second order system, the trend is similar to the first order system for low frequencies, but instabilities may appear at frequencies lower than those of the first order system. The most significant effect of the second order system is that the admittance is extremely oscillatory between moderately high frequency ranges. Author

N88-15033# Physical Sciences, Inc., Andover, Mass.
EXPERIMENTAL AND THEORETICAL STUDY OF CONDENSATION IN MULTICOMPONENT MIXTURES Quarterly Report No. 12, 15 Nov. 1986 - 14 Feb. 1987
R. Waterhouse, M. B. Frish, and G. Wilemski Sep. 1987 13 p
(Contract DE-AC02-84ER-13154)
(DE88-002715; DOE/ER-13154/12; PSI-154/TR-721) Avail: NTIS HC A03/MF A01

This report covers the work performed during the twelfth quarter of a multilayer program to study the condensation of multicomponent vapors in a supersonic nozzle. New data for the binary system of 1-propanol and water are presented, discussed, and compared with theoretically predicted behavior. DOE

N88-15034# Bhabha Atomic Research Centre, Bombay (India).
STABILIZED X-RAY GENERATOR POWER SUPPLY
S. Saha, K. V. Purushotham, and S. K. Bose 1986 34 p
(DE88-700297; BARC-1324) Avail: NTIS (US Sales Only) HC A03/MF A01

X-ray diffraction and X-ray fluorescence analysis are very much adopted in laboratories to determine the type and structure of the constituent compounds in solid materials, chemical composition of materials, stress developed on metals etc. These experiments need X-ray beam of fixed intensity and wave length. This can only be achieved by X-ray generator having highly stabilized tube voltage and tube current. This paper describes how X-ray tube high voltage and electron beam current are stabilized. This paper also highlights generation of X-rays, diffractometry and X-ray fluorescence analysis and their wide applications. Principle of operation for stabilizing the X-ray tube voltage and current, different protection circuits adopted, special features of the mains H.V. transformer and H.T. tank are described in this report. DOE

N88-15035# Association pour la Recherche et le Developpement Des Methodes et Processus Industriels, Paris (France).
STUDY OF THE VAPOR-LIQUID EQUILIBRIA USED IN THE FABRICATION PROCESS OF HYDROGEN BY THERMOCHEMISTRY Final Report
P. Berthelot, C. Houzelle, S. Laugier, D. Legret, R. Muehbauer, H. Renon, and D. Richon 1986 55 p In FRENCH
(DE88-900239; EUR-10346) Avail: NTIS (US Sales Only) HC A04/MF A01

Two new flow apparatuses have been designed and constructed to determine vapor-liquid equilibria of very corrosive components. Main differences between the two apparatuses are their temperature and pressure ranges of operation. When using each of the two equipments, a monophasic mixture is introduced continuously at constant pressure into a thermostated equilibrium coil. The vapor and liquid leave the coil at equilibrium and enter a separator from which each phase is withdrawn continuously to maintain a constant level of the interface in the separator. Samples taken from the outcoming flows are analyzed. The first apparatus (medium temperature-low pressure) was developed to test the new dynamic method. The experimental results obtained for the system water-acetic acid are in good agreement with those of Othmer et al., (1952). The second apparatus for measurements up to 50 bar and 823 K was used to obtain SO -H O equilibrium data. The results obtained are presented; at low pressures they are in good agreement with tabulated data of Gmitro and Vermeulen (1963, 1964). DOE

N88-15036*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CARBON DIOXIDE CHAPERON EFFICIENCY FOR THE REACTION H + O2 + M YIELDS HO2 + M FROM IGNITION DELAY TIMES BEHIND REFLECTED SHOCK WAVES
Theodore A. Brabbs and Thomas F. Robertson May 1987 15 p Presented at the Central States Meeting of the Combustion Inst., Argonne, Ill., 11-13 May 1987
(NASA-TM-100125; E-3489; NAS 1.15:100125) Avail: NTIS HC A03/MF A01 CSCL 21B

Ignition delay times for stoichiometric hydrogen-oxygen in argon with and without carbon dioxide were measured behind reflected shock waves. A 20-reaction kinetic mechanism models the measured hydrogen-oxygen delay times over the temperature range 950 to 1300 K. The chaperon efficiency for carbon dioxide determined for the hydrogen-oxygen carbon dioxide mixture was 7.0. This value is in agreement with literature values but much less than a recent value obtained from flow tube experiments. Delay times measured behind a reflected shock wave were about 20% longer than those measured behind incident shock waves. The kinetic mechanism successfully modeled the high-pressure data of Skinner and the hydrogen-air data of Stack. It is suggested that the lowest temperature points for the hydrogen-air data of Slack are unreliable and that the 0.27-atm data may illustrate a case where vibrational relaxation of nitrogen is important. The reaction pathway HO2 yields H2O2 yields OH yields H was required to model the high-pressure data of Skinner. The successful modeling of the stoichiometric hydrogen-air data demonstrates the appropriateness of deriving kinetic models from data for gas mixtures highly diluted with argon. The technique of reducing a detailed kinetic mechanism to only the important reactions for a limited range of experimental data may render the mechanism useless for other test conditions. Author

N88-15037# Indiana Univ., Bloomington. Dept. of Chemistry.
MODEL Cu/ZnO CATALYSTS FOR METHANOL SYNTHESIS: THE ROLE OF SURFACE STRUCTURE Progress Report
C. T. Campbell 1987 4 p
(Contract DE-FG02-86ER-13625)
(DE88-002354; DOE/ER-13625/T1) Avail: NTIS HC A02/MF A01

Model catalysts were constructed in order to give insight into the nature of the active sites on Cu/ZnO catalysts. None of these model catalysts (vapor-deposited Cu overlayers on ZnO(0001); Cu(111); Cu(111) with a ZnO(sub x) monolayer) gave measurable

rates of methanol production. The electronic structure of Cu substituted in the bulk and the surface of ZnO(0001) and adsorbed on ZnO(0001) was calculated. Chemisorption of simple molecules important in methanol synthesis on Cu, ZnO, Cu/ZnO clusters was studied with the same (INDO) calculations. The reaction of vapor-deposited Al with Ru(0001) and the interaction of CO with the resulting Al/Ru surface were studied. DOE

N88-15038# Pittsburgh Univ., Pa. Dept. of Chemistry.
STUDIES OF SUPPORTED METAL CATALYSTS Final Report, 1 May 1984 - 30 Apr. 1987
D. M. Hercules Apr. 1987 8 p
(Contract DE-AC02-79ER-10485)
(DE88-002546; DOE/ER-10485/T5) Avail: NTIS HC A02/MF A01

Methodology has been developed to use ESCA for quantitative measurement of the distribution of species on catalyst surfaces. Additionally, the quantitative aspects of Raman spectroscopy have been explored, and the technique has been used to supplement quantitative ESCA measurements. The role of additives on the structure of catalysts has been studied. Specifically, we have investigated the effect on the isoelectric point of the support and thus the effect on catalyst preparation. Detailed studies have been completed on the effect of B and Ti on the state, dispersion, and reactivity of Co/Al2O3 and Ni/Al2O3 catalysts, respectively. DOE

N88-15039# Cornell Univ., Ithaca, N.Y.
EXPERIMENTAL AND THEORETICAL STUDIES OF DENSE FLUID MIXTURES Scientific and Technical Progress Report
Nov. 1987 8 p
(Contract DE-FG02-86ER-13623)
(DE88-002710; DOE/ER-13623/1) Avail: NTIS HC A02/MF A01

A summary is given of work on the measurement of the thermodynamic properties, equations of state, and sound velocity of CCl4, n-pentane, neopentane, CCl3F, etc. No numerical data are given. DOE

N88-15040# State Univ. of New York, Stony Brook. Dept. of Mechanical Engineering.
THEORETICAL STUDIES OF MULTICOMPONENT MIXTURES: PHASE EQUILIBRIUM AND TRANSPORT Progress Report
J. M. Kincaid Nov. 1987 5 p
(Contract DE-FG02-87ER-13648)
(DE88-002717; DOE/ER-13648/1) Avail: NTIS HC A02/MF A01

This report begins, in Section A, by briefly noting the completion of three projects that began under previous DOE support. Section B describes a powerful technique developed for performing phase equilibrium calculations (both flash and dew/bubble). Finally, a new method for predicting the shear viscosity of simple mixtures is described in Section C. DOE

N88-15041# Stuttgart Univ. (West Germany). Inst. fuer Technische Thermodynamik und Thermische Verfahrenstechnik.
PHOTOACOUSTIC INFRARED LASER SPECTROSCOPY FOR ANALYZING GASEOUS CONTAMINANTS Ph.D. Thesis [DIE PHOTOAKUSTISCHE INFRAROT-LASERSPEKTROSKOPIE ZUR SCHADGASANALYSE]
Wolfgang Hurdelbrink 1986 75 p In GERMAN
(ETN-88-90805) Avail: NTIS HC A04/MF A01

Photoacoustic laser spectroscopy for trace gas analyses is discussed. Concentrations up to the ppb-scale and even molecular parameters as the line strength can be measured with great precision. A developed cell, 102 cm long, using 50 mw (monomode), with comparatively less laser energy than a carbon dioxide laser, can indicate an absorption difference up to 0.00001, which corresponds to 44 ppb of CO. ESA

N88-15042# Goettingen Univ. (West Germany).
LYMAN-ALFA/OH-RESONANCE-ABSORBTION TS AND SIMULATION CALCULATIONS FOR THE INVESTIGATION OF THE INDUCTION BEHAVIOR OF METHANE/ETHANE/OXYGEN MIXTURES IN REFLECTED SHOCK WAVES Ph.D. Thesis [LYMAN-ALPHA/OH-RESONANZABSORPTIONSMESSUNGEN UND SIMULATIONSRECHNUNGEN ZUM INDUKTIONSVERHALTEN VON METHAN/ETHAN/SAUERSTOFF-GEMISCHEN IN REFLEKTIERTEN STOSSWELLEN]
Klaus-Juergen Niemitz 1985 97 p In GERMAN
(ETN-88-90806) Avail: NTIS HC A05/MF A01

The effects of the CH4 and C2H6 concentrations on the induction time of hydrocarbon-oxygen mixtures was investigated in order to improve the understanding of complex combustion processes. Induction measurements using the OH-absorption method were performed for CH4 concentrations between 0.1 percent and 10 percent and a constant O2-concentration of 20 percent. Lyman-alpha induction measurements were performed on highly diluted CH4/O2 mixtures. The measured induction times agree well with the calculated values. The reaction mechanism was simulated using the sensitivity analysis, allowing the determination of the reactions that substantially influence the global reaction. ESA

N88-15577# Joint Publications Research Service, Arlington, Va.
DIMENSIONS OF IGNITION ZONES IN BLOW-OUTS OF COMBUSTIBLE GASES FROM RECTANGULAR AND CIRCULAR PORTS Abstract Only
Yu. A. Kondrashkov, V. P. Tomilin, and G. G. Shevyakov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 14 Transl. into ENGLISH from Fizika Goreniya i Vzryva (Novosibirsk, USSR), v. 22, no. 5, Sep. - Oct. 1986 p 19-22 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15625*# Alabama Univ., Huntsville. Dept. of Chemistry.
RAMAN SPECTROSCOPIC INVESTIGATIONS OF Hg-Cd-Te MELTS
Anny Morrobel-Sosa *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 38 p (For primary document see Summer Faculty Fellowship Program 38 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N88-15043# Colorado School of Mines, Golden.
FATIGUE, FRACTURE AND STRAIN HARDENING OF HIGH CARBON HARDENED ALLOY STEEL Final Report, Jul. 1984 - Mar. 1987
George Krauss 4 Jun. 1987 6 p
(Contract DAAG29-84-K-0127)
(AD-A186101; ARO-21316.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11F

Medium and high carbon alloys steels have been heat treated to microstructures of low-temperature tempered martensite and retained austenite. Four point bending fatigue testing of 0.8 pct C steels showed that low cycle fatigue resistance was directly related to retained austenite content. The strain-induced transformation of retained austenite substantially increased strain hardening rates of the composite tempered martensite-austenite microstructures at high strains and increased the number of cycles required to initiate fatigue cracks at prior austenite grain boundaries in specimens with the highest retained austenite content. Transmission electron microscopy identified the transition carbides formed on tempering as the orthorhombic eta carbide, and the

increasing density of the transition carbides with increases in carbon content was the major carbon-dependent structural parameter which correlated with flow stresses and strain hardening rates in medium carbon tempered martensite. Elastic limits, as measured with strain gages mounted in compression specimens, decreased with increasing retained austenite content. In medium carbon steels with lath martensite morphologies the retained austenite transformed to martensite by stress induced mechanisms, and in high carbon steels with plate martensite morphologies, the retained austenite transformed by strain-induced mechanisms. GRA

N88-15044# Washington Univ., Seattle. Dept. of Mechanical Engineering.
A COMPOSITE GRATING FOR MOIRE INTERFEROMETRY
F. X. Wang, B. S. Kang, and A. S. Kobayashi Jul. 1987 24 p
(Contract N00014-85-K-0187)
(AD-A186330; UWA/DME/TR-87/57) Avail: NTIS HC A03/MF A01 CSCL 20F

The theoretical background and the experimental verification of a new composite grating with two different grating densities, which was developed for simultaneous small and large displacement measurements for a single specimen using moire interferometry, are presented in this paper. A composite grating with line densities of 1200 and 300 lines/mm is then used to study the changes in the displacement field and the approximate J-integral values of a 5052-H32 aluminum, single edge notched (SEN) specimen under increasing load. GRA

N88-15045# Dayton Univ., Ohio.
METALLURGICAL PROCESSES IN MULTI-COMPONENT RARE EARTH-TRANSITION METAL PERMANENT MAGNET ALLOYS Final Report, 14 Dec. 1983 - 30 Apr. 1987
A. E. Ray Jun. 1987 11 p
(Contract DAAG29-84-K-0012)
(AD-A186401; UDR-TR-87-92; ARO-21026.5-MS) Avail: NTIS HC A03/MF A01 CSCL 11F

A primary objective of this research has been to test and refine a model to describe the metallurgical behavior of Sm(Co,Fe,Cu,Zr) alloys and the complex relationships between the compositions, heat treatments, microstructures and compositions of the phase observed, and the corresponding magnetic properties developed by the alloys. A second objective was to develop laboratory techniques and procedures for the processing of 2:17 type permanent magnet in order to be reasonably confident that observed variations in the magnetic and other physical properties measured would reflect intentional changes in compositional and heat treating parameters. A third objective of developing higher energy product 2:17 type permanent magnets than were known at the beginning of the research effort was not accomplished. GRA

N88-15046# Centre d'Essais Aeronautique Toulouse (France).
CHARACTERIZATION OF CURRENT STEELS. THE 35 NCD 16 ALLOY IN 30 mm DIAM LAMINATED BARS MADE BY AUBERT AND DUVAL Progress Report No. 9 [CARACTERISATION D'ACIERS COURANTS. ALLIAGE 35 NCD 16. DEMI-PRODUIT: BARRE LAMINEE A 30 MM DE DIAMETRE. ELABORATEUR: AUBERT ET DUVAL]
M. Notton 10 Apr. 1987 67 p In FRENCH
(CEAT-41/N/76; M6-645900; ETN-88-90900) Avail: NTIS HC A04/MF A01

Tests to characterize construction steels, including chemical analysis, thermal treatments, microstructure, mechanical properties, crack propagation, and fatigue life are summarized. The results are satisfactory, particularly the values of axial fatigue obtained with un-notched specimens. ESA

N88-15047# Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.
COMPUTER SIMULATION OF IMPURITIES AND INTERFACES IN BODY CENTERED CUBIC METALS
A. Q. Malik, M. Ahmad, J. I. Akhtar, M. A. Sheikh, and K. A. Shoaib Dec. 1986 26 p
(PB88-108162; PINSTECH/NPD-119) Avail: NTIS HC A03/MF A01 CSCL 11F

Computations were carried out to examine the structure of interfaces i.e., grain boundaries and their interactions with the self-interstitial type impurities in body centered cubic (BCC) metals. The Johnson Jo potential for alpha-iron was used for these calculations. A large binding energy between a group of zone axes /110/-split interstitial and grain boundaries was recorded. The results suggest the formation of interstitial dislocation loops at grain boundaries in irradiated bcc metals. GRA

N88-15048# California Univ., Berkeley. Lawrence Berkeley Lab.
MICROSTRUCTURAL OBSERVATIONS OF THE Sn-Pb SOLDER/Cu SYSTEM AND THERMAL FATIGUE OF THE SOLDER JOINT Ph.D. Thesis
D. R. Frear Jun. 1987 218 p
(Contract DE-AC03-76SF-00098)
(DE88-001392; LBL-23879) Avail: NTIS HC A10/MF A01

The microstructural mechanisms that lead to solder joint failures in thermal fatigue are studied. The solders used were 5Sn-95Pb and 60Sn-40Pb joined to Cu. The precipitation process of Beta-Sn in 5Sn-95Pb was fully characterized. On fast cooling from single phase alpha-Pb the Sn precipitates homogeneously. On slow cooling the precipitation process is cellular. The 60Sn-40Pb had a two phase microstructure. The Sn-rich phase was interconnected and polygranular. Both phases, and Sn grains, coarsened with time at 125 C. Coarsened 60Sn-40Pb microstructure was deleterious to the mechanical properties. Failures initiated and propagated through interfacial intermetallics only at extremely fast strain rates. Interfacial intermetallics had no influence on thermal fatigue properties. Cu6Sn5 eta-phase whiskers formed at the intermetallic solder interface. Thermal cycling tests were performed on both joints using a -55 C to 125 C cycle and 19 percent imposed shear strain. Failures in 5Sn-95Pb occurred at Pb grain boundaries. Isothermal fatigue tests on 5Sn-95Pb give similar results when compared to thermal fatigue. A heterogeneously coarsened region of both Pb and Sn-rich phases develops within the 60Sn-40Pb solder joints. Cracks initiate and propagate through the heterogeneously coarsened region. Heterogeneous coarsening and failure occurs in high and low thermal cycles. Isothermal fatigue cannot be compared to thermal fatigue results of 60Sn-40Pb on Cu. DOE

N88-15049# Oak Ridge National Lab., Tenn.
PERFORMANCE OF LOW UPPER-SHELF MATERIAL UNDER PRESSURIZED-THERMAL-SHOCK LOADING (PTSE-2)
R. H. Bryan, B. R. Bass, S. E. Bolt, J. W. Bryson, W. R. Corwin, R. K. Nanstad, J. G. Merkle, and G. C. Robinson 1987 28 p Presented at the 15th Water Reactor Safety Information Meeting, Gaithersburg, Md., 26 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE88-002297; CONF-8710111-4) Avail: NTIS HC A03/MF A01

The second pressurized-thermal-shock experiment (PTSE-2) of the Heavy-Section Steel Technology Program was conceived to investigate fracture behavior of steel with low ductile-tearing resistance. PTSE-2 was designed primarily to reveal the interaction of ductile and brittle modes of fracture and secondarily to investigate the effects of warm prestressing. A test vessel was prepared by inserting a crack-like flaw (1 m. by approx 15 mm) of well-defined geometry on its outside surface. The instrumented vessel was placed in a test facility in which it was initially heated to a uniform temperature and was then concurrently cooled outside and pressurized inside. These actions produced an evolution of temperature, toughness, and stress gradients relative to the prepared flaw that was appropriate to the planned objectives. The experiment was conducted in two separate transients, each one starting with the vessel nearly isothermal. The first transient induced a warm prestressed state, during which K(sub I) first exceeded K(sub Ic). This was followed by repressurization until a cleavage fracture propagated and arrested. The final transient was designed to produce and investigate a cleavage crack propagation followed

by unstable tearing. During this transient the fracture events occurred as had been planned. DOE

N88-15050# Baotou Inst. of Metals Research (China).
STUDY ON SUBSTRUCTURES OF MARTENSITE IN STEELS CONTAINING RARE EARTH METALS
B. Chen, Y. Huang, X. Wang, and B. Lin 1986 8 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143996; ISTIC-TR-C-000083) Avail: NTIS HC E03/MF E01 CSCL 11F

Thin foil specimens of Cr-Ni2-Mo-V and Cr-Ni4-Mo-V structural steels and a Fe-0.7C alloy were observed by means of a transmission electron microscope (TEM) in order to explore the influence of misch metal (REM) on the martensitic morphology and tempering process as well as to explain the mechanism of the effect of REM on the increase in toughness of the steels. The experimental results showed that the amount of the twin substructure of the three alloys with REM additions decreased remarkably. It was found that the carbide particles of tempered Cr-Ni2-Mo-V structural steel containing REM become smaller and distributed more uniformly. Thus, all these factors led to the increase in toughness of steel. Results of mechanical property tests showed that REM addition might increase the toughness of steel. GRA

N88-15051# Academia Sinica, Shenyang (China). Inst. of Metal Research.
SULFUR-INDUCED DUCTILITY-DIP CRACKING IN WELD METAL OF LOW-CARBON STEEL
E. Yu, H. Ying, Q. Liu, and Z. Si 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143814; ISTIC-TR-C-000061) Avail: NTIS HC E03/MF E01 CSCL 11F

Two types of hot cracks of low-carbon steel weld metal, namely, solidification cracks and ductility-dip cracks have been verified by using hot cracking tests and hot ductility tests. The formation temperature ranges of two types of hot cracks are 1480-1450 C and 1100-850 C, respectively. The surface morphology of ductility-dip cracks is intergranular fracture with dimple zones and smooth facets containing voids which are associated with (Mn,Fe)S inclusions. These types of cracks can be prevented by increasing manganese content in weld metal. GRA

N88-15052# Academia Sinica, Shenyang (China). Institute of Metal Research.
EFFECT OF RARE EARTH ELEMENTS ON THE HYDROGEN-INDUCED CRACKING IN HIGH STRENGTH LOW ALLOY STEEL
P. Liu and Z. Y. Si 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143806; ISTIC-TR-C-000060) Avail: NTIS HC E03/MF E01 CSCL 11F

Effects of rare earth elements (RE) on hydrogen induced cracking in 15 MnV high strength low alloy steel (HSLAS) were investigated by using implant test. It is found that the sensitivity to hydrogen induced cracking in the heat affected zone(HAZ) is reduced by adding RE in the steels. This is because RE not only spheroidizes the MnS inclusions but also decreases the diffusible hydrogen content through absorbing hydrogen. The technique of ion microprobe analysis was adopted to measure the distribution of residual hydrogen in weld and HAZ. The analysis of stress concentration caused by the inclusion in HAZ is based on the elasticity theory. It is proposed that the ratio of RE to sulphur contents (RE/S) in HSLAS should be controlled within the range of 3 to 6. Author

N88-15053# Xian Jiaotong Univ. (China). Inst. for Strength of Metals.
INVESTIGATION OF THE AUTO-TEMPERING OF LOW-CARBON MARTENSITE
H. Zhou, Y. Li, and J. Qi 1986 11 p Sponsored by Inst. of Scientific and Technical Information of China, Beijing
(PB87-143970; ISTIC-TR-C-000081) Avail: Issuing Activity CSCL 11F

Investigations were made on the effects of Ms temperature and rate of cooling as major factors and alloying as a minor factor upon the extent of auto-tempering by using five low carbon steels. Transmission electron microscopy observations were made on the precipitation of carbides from the low carbon martensite matrix, their shape, size and distribution being determined and crystal structure identified by selected area electron diffraction. Tensile, impact and ductile fracture toughness tests were made on specimens in auto-tempered, naturally aged and 200 C tempered conditions. Basing upon the obtained experimental results a discussion is presented concerning the possibility of utilizing auto-tempering effect to heat treatment practice pointing out the value in energy conservation if the conventional tempering is substituted by sufficient auto-tempering. Author

N88-15054# Harbin Inst. of Tech. (China).
SLIDING-WEAR PROPERTIES OF RETAINED AUSTENITE IN CARBURIZED LAYER
T. C. Gao and G. H. Wu 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-149092; ISTIC-TR-C-000092) Avail: NTIS HC E03/MF E01 CSCL 11F

The effects of percentage of retained austenite (rR) in carburized layer on wear resistance of steel 18CrNiW vary with wear condition. The rR exhibits excellent properties of resisting heavy load and adhesion under oxidating wear condition. The heavy load resistance varies with percentage of rR, existing the minimum values sensitive to heavy load resistance. The effect of rR is not conspicuous under severe wear condition. Double-pumping effect is found to be due to the variation of the oxidation film distribution. This kind of effect improves the state of lubrication and, consequently, affects the wear resistance of rR. GRA

N88-15055# Academia Sinica, Beijing (China). Inst. of Aeronatuical Materials.
EFFECT OF OVERLOAD RATIOS ON FATIGUE CRACK GROWTH BEHAVIOR IN Ti-6Al-4V ALLOY
J. Ouyang, M. Yan, and D. Song 1986 12 p Sponsored by Institute of Scientific Technical Information of China, Beijing
(PB87-147062; ISTIC-TR-C-000048) Avail: Issuing Activity CSCL 11F

The effect of various overload ratios, Q(sub 01)=1.3-2.8 on the fatigue crack growth rate under single tensile overloading for a Ti-6Al-4V alloy was investigated. The variation of fatigue crack tip region and fracture surfaces as well as the dislocation substructures ahead of the crack tip within the plastic zone under different overload ratios was evaluated. From a close microscopic analysis of these specimens, it was found that the main causes of the retardation effect induced by the tensile overloading may be ascribed to the following factors: (1) the closure stress in the wake of the crack tip; (2) the compressive residual stresses ahead of the crack tip; and (3) the strain hardening effect in the overload plastic zone. A schematic of the mechanism of crack growth retardation behavior under a tensile overload was proposed. GRA

N88-15056# Harbin Inst. of Tech. (China). Dept. of Metals and Technology.
NEW MECHANISM OF THE HIGH TEMPERATURE (REVERSIBLE) TEMPER BRITTLENESS OF ALLOY STEELS
T. C. Lei, C. H. Tang, and M. Su 1986 13 p Sponsored by Inst. of Scientific and Technical Information of China, Beijing
(PB87-143954; ISTIC-TR-C-000079) Avail: NTIS HC E03/MF E01 CSCL 11F

Impact toughness tests, low frequency internal friction measurements, TEM and SEM structural analyses were carried out on a series of medium carbon, low alloy steels. Experimental results indicate that the high temperature (reversible) temper embrittlement of these steels is always accompanied with the obvious decrease of Koster peak height. A new mechanism was suggested that the temper embrittlement is considered as the

result of the aging of dislocations by precipitated ultrafine Fe3 C(N) particles. The beneficial effect of molybdenum on inhibiting this embrittlement lies in the prevention of aging processes by its strong affinity to C(N) atoms. Author

N88-15057# Harbin Inst. of Tech. (China). Welding Div.
STUDY ON THE CRYOGENIC TOUGHNESS OF STAINLESS STEEL WELD METALS
Z. Zhang, J. Niu, L. Shu, and Z. Li 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143830; ISTIC-TR-C-000063) Avail: NTIS HC E03/MF E01 CSCL 11F

An experimental study is described on the cryogenic toughness of austenitic stainless weld metals deposited by argon arc welding. The fracture surface of the impact specimen was analyzed by scanning electron microscope. Fractographs of base metal (austenitic structure) fractured at low temperature exhibit a dimple pattern, while those of the weld metal (gamma and delta duplex structure) exhibit cleavage and a dimple pattern. Pulsed argon arc welding with low heat input can refine the weld metal structure and modify the ferrite morphology, thus improving the toughness of gamma and delta welds at low temperature. These results show that the delta ferrite morphology plays an important role in toughness and fracture behavior of gamma and delta welds at low temperature. Author

N88-15058# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
INVESTIGATION OF IMPURITY DEFECTS IN ALPHA-IRON BY MOLECULAR DYNAMICS METHOD
Yu. R. Kevorkyan 1986 .8 p In RUSSIAN
(DE88-700355; IAE-4332/11) Avail: NTIS (US Sales Only) HC A02/MF A01

Investigation of the configuration of impurity defects in alpha-iron by the molecular dynamics method is presented. The Jhonson model potential has been used to calculate the interaction of matrix atoms. The impurity-matrix atom interaction is described by the same form of the potential shifted along the axis of interatomic distances for a definite value. The correspondence between the shift value and change in the radius of the impurity defect is established on the basis of calculation of the relaxation volume. Possible configurations of the impurity - interstitial matrix atom complexes are obtained for the given model of the impurity defect, dimensional boundaries of possible transitions between different configurations are determined. Formation and bound energies, relaxation volumes of impurity defects are calculated. DOE

N88-15059# Japan Atomic Energy Research Inst., Tokyo. Dept. of Fuels and Materials Research.
CREEP TEST OF HASTELLOY X FOR USE AS THE COMPONENTS OF OGL-1 IN HELIUM ENVIRONMENT
Yutaka Ogawa and Yuji Kurata Jun. 1987 27 p In JAPANESE; ENGLISH summary
(DE88-750289; JAERI-M-87-076) Avail: NTIS (US Sales Only) HC A03/MF A01

Hastelloy X is used for inner and flow tubes of OGL-1 (Oarai Gas Loop No. 1) installed in JMTR. The tubes were produced by a special procedure, BTA (Boring and Trepanning Association), because of their form of thin wall thickness and large diameter. By this procedure the central part of a forged bar was hollowed out. Creep rupture data for the tube material have been obtained up to 15,000 hr in the longest test period in air. In practice, since the tubes were to be exposed to helium gas, the material was tested in a simulated helium environment. The results obtained were compared with the air data and also the other set of creep data accumulated with Hastelloy XR. The latter data contain those on tube and bar materials and have been provided for design of HTGR. The results obtained by the test at 900 deg C in helium to the maximum test duration up to 10,000 hr yielded the following conclusions; (1) Hastelloy X for OGL-1 (OGL-HX hereafter) showed longer rupture life accompanied by smaller cracks in helium than that tested in air. (2) Rupture life was shorter in the following order; the tube material of Hastelloy HR (HR hereafter), the bar material of XR and OGL-HX. (3) Rupture elongation was the highest in the bar material of XR and minimum in tube material of XR. The value OGL-HX was middle of the two. (4) Creep rate was lowest for OGL-HX, however in the lower stresses range the value of the tube material of XR approached to that of OGL-HX. The results were discussed from the view point of minor impurities, production processes and microstructure eg. annealing twin. DOE

N88-15060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE MODELING OF THERMAL BARRIER COATINGS FOR AIRCRAFT GAS TURBINE ENGINES
Robert A. Miller [1988] 11 p Prepared for the 33rd International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, The Netherlands, 5-9 Jun. 1988; sponsored by ASME
(NASA-TM-100283; E-3921; NAS 1.15:100283) Avail: NTIS HC A03/MF A01 CSCL 11F

Thermal barrier coating life models developed under the NASA Lewis Research Center's Hot Section Technology (HOST) program are summarized. An initial laboratory model and three design-capable models are discussed. Current understanding of coating failure mechanisms are also summarized. Author

N88-15061# Sandia National Labs., Albuquerque, N. Mex.
THE EFFECT OF DEFORMATION RATE ON JBK-75 STAINLESS STEEL FORGINGS
B. C. Odegard Oct. 1987 24 p
(Contract DE-AC04-76DR-00789)
(DE88-001696; SAND-87-8242) Avail: NTIS HC A03/MF A01

A parametric study was conducted to evaluate the effect of forging rate and forging temperature on the strength and microstructure of a precipitation-hardened, austenitic stainless steel forging. High and low forging rates were achieved using a high energy rate forging (HERF) process and a low velocity mechanical press (MP), respectively. The forging geometry required a two-stage forging sequence. The first stage or preform was identical for both forging processes. The final stage used similar die geometries with minor modifications to accommodate the attachment to the respective hammers. The resulting microstructure and mechanical properties were significantly different. These differences are attributed to the effects of strain rate and temperature. DOE

N88-15062# Los Alamos National Lab., N. Mex.
COMPUTER SIMULATION OF PENCIL GLIDE IN B.C.C. METALS
A. D. Rollett and U. F. Kocks 1987 7 p Presented at the 8th International Conference on Textures of Materials, Santa Fe., N. Mex., 21 Aug. 1987
(Contract W-7405-eng-36)
(DE88-001802; LA-UR-87-3619; CONF-8708162-1) Avail: NTIS HC A02/MF A01

An existing computer code for simulation of texture development in polycrystals has been modified to model pencil glide as observed in some bcc metals. Pencil glide can be thought of as a limiting case where the slip direction is restricted to (111) directions but the slip plane is arbitrary. The existing code simulates restricted glide, i.e., (111)(110) slip systems, by using the Bishop-Hill method to find the active vertex of the single crystal yield surface for each grain. It then corrects this trial solution by using a nonlinear viscous law based on the total (111)-resolved stress component. Only a small increase in computation time is required compared to restricted glide. The results of the pencil glide modification of the code are that the texture development in tension is essentially the same as for restricted glide but that significant differences appear in plane strain compression (rolling). The Taylor Factor in tension for a random polycrystal is found to be 2.74. DOE

N88-15063# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
THE INFLUENCE OF GRAIN BOUNDARY CHEMISTRY AND STRUCTURE ON THE INTERGRANULAR ATTACK AND INTERGRANULAR STRESS CORROSION CRACKING OF AUSTENITIC ALLOYS Progress Report, 1 Aug. 1986 - 31 Jul. 1987
G. S. Was Oct. 1987 23 p
(Contract DE-FG02-85ER-45184)
(DE88-002436; DOE/ER-45184/3) Avail: NTIS HC A03/MF A01

Brief descriptions and results are presented for the following areas: (1) grain boundary studies which were performed in order to determine the effects of B on microstructure and intergranular precipitation in Ni-16Cr-9Fe-C alloys; (2) stress corrosion cracking in high purity water and caustic solutions in Inconel 600, AFU188, and AFU41 alloys; (3) simulations on model grain boundaries of Ni-16Cr-9Fe with and without hydrogen. DOE

N88-15064# California Univ., Berkeley. Lawrence Berkeley Lab.
MICROSTRUCTURE AND MAGNETIC PROPERTIES OF COBALT-CHROMIUM ALLOYS
L. H. Chan Sep. 1987 79 p
(Contract DE-AC03-76SF-00098)
(DE88-002762; LBL-24074) Avail: NTIS HC A05/MF A01

Microstructural details and magnetic properties of Co-Cr in the thin film form are being extensively investigated. It is also worthwhile to consider Co-Cr as a metallurgical system. Objectives of this study were to investigate: the microstructural evolution of these alloys as function of Cr content; the magnetic properties of these alloys as function of Cr content and to extend this understanding to elucidate the microstructure/property correlations. It was found that Cr additions enhanced the fcc phase retention and subsequently the fault density. The additions also decreased saturation magnetization and grain size. Furthermore, the intrinsic coercivity was fairly insensitive to Cr additions for a given grain size and the coercivity increased with decreasing grain size. DOE

N88-15065# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
STUDY OF THE EMBEDDED ATOM METHOD OF ATOMISTIC CALCULATIONS FOR METALS AND ALLOYS Progress Report, 1 Mar. 1987 - 28 Feb. 1988
R. A. Johnson Nov. 1987 11 p
(Contract DE-FG05-86ER-45246)
(DE88-002798; DOE/ER-45246/2; UVA-527340/MS88/102)
Avail: NTIS HC A03/MF A01

The relationships between the physical input and output of the Embedded Atom Method (EAM) used in atomistic calculations for metals and alloys and the model functions and parameters are being investigated. An analytic fcc EAM model has been derived based on short range approximations to the input functions in EAM and has been studied both analytically and numerically for the fcc lattice. This model has been extended to longer ranges and applied to both fcc and hcp metals. The correspondence between models based on density functional theory (EAM), tight binding methods, and effective medium theory has been reported. The reasons for difficulty in applying EAM to bcc metals is under study and a new form of alloy potential which retains general properties of pure metal potentials has been developed. DOE

N88-15094# Yamagata Univ. (Japan). Section of Technology.
STRUCTURAL RELAXATION AND MECHANICAL PROPERTIES OF AMORPHOUS Fe-Zr ALLOYS
Nasu Toshio, Nagaoka Kunio, Yoshida Hiroaki, Ajiki Isao, and Suganuma Eiichi *In its* Bulletin of the Yamagata University (Engineering), Volume 20, No. 1, January 1988 Jan. 1988 p 43-50 In JAPANESE; ENGLISH summary (For primary document see N88-15091 07-31)
Avail: NTIS HC A07/MF A01

N88-15617*# Auburn Univ., Ala. Dept. of Physics.
ATOMIC OXYGEN EFFECTS ON METALS
Albert T. Fromhold *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 28 p (For primary document see Summer Faculty Fellowship Program 28 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

N88-15066# California Inst. of Tech., Pasadena.
BIOPOLYMERS: PROTEIN AND NUCLEIC ACIDS Annual Report, 15 Sep. 1986 - 14 Sep. 1987
John H. Richards, John N. Abelson, Leroy E. Hood, Melvin I. Simon, and Judith L. Campbell 15 Sep. 1987 27 p
(Contract N00014-86-K-0755)
(AD-A185837) Avail: NTIS HC A03/MF A01 CSCL 07C

The work focuses on learning the principles that govern interactions between proteins and nucleic acids. With these principles as guides we are synthesizing peptides (of about 50 amino acids) that bind to specific regions of DNA. Various reactive functionalities are being attached to the synthetic peptides to generate reagents that cleave DNA specifically at the site to which the peptide binds. The work also involves biophysical and theoretical studies of the protein/nucleic acid complexes in order to expand the understanding of the principles of protein binding to nucleic acid as well as the development of improved procedures for the chemical synthesis of peptides. GRA

N88-15067# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
THERMOPLASTIC ELASTOMERS AS LOVA BINDERS Quarterly Report, Jan. 1987 - Apr. 1987
James C. Chien, Richard J. Farris, C. P. Lillya, and H. H. Winter 1987 17 p
(Contract N00014-85-K-0880)
(AD-A185864) Avail: NTIS HC A03/MF A01 CSCL 19A

The prediction of the mechanical behavior of particulate composite under thermal or mechanical stresses is of great importance in the effective design of solid propellants. The presence of voids due to the debonding of oxidizer particles results in significant changes in burn rate which cannot be tolerated. Prediction of the stress strain and volumetric behavior of particulate composites over the range of strain where debonding occurs would allow design of proper processing techniques to avoid this problem. The method presented appears to have the potential to accurately predict the s strain and dilatation strain curves for systems filled with spherical particles subjected to uniaxial tension and superimposed pressure. GRA

N88-15068# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
THERMOPLASTIC ELASTOMERS AS LOVA BINDERS Quarterly Report, Apr. 1987 - Jul. 1987
James C. Chien, Richard J. Farris, C. P. Lillya, and H. H. Winter 1987 35 p
(Contract N00014-85-K-0880)
(AD-A185865) Avail: NTIS HC A03/MF A01 CSCL 19A

The energy balance type of approach to modelling the debonding behavior of highly filled composites such as propellants described in earlier reports is being more fully developed. This approach equates the change in strain energy of a sample during debonding to the work necessary to create new surfaces on the debonded particles. A high pressure gas dilatometer has been constructed and was recently tested for the first time. This instrument concurrently measures stress and volume changes

which occur in a sample during uniaxial extension. Superimposed hydrostatic pressures of up to 1000 psi may be used. It appears to operate properly, and is sensitive to small changes in pressure and load. Atmospheric testing of samples is scheduled for immediate implementation. The bulk synthesis of polyurethane from tolylene 2,4-diisocyanate and diols or triols of poly (propylene oxide) to form void-free samples was accomplished after some trouble. GRA

N88-15069# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF POLYMER MATERIALS FOR MANUFACTURING OPTICAL PARTS
D. Ye. Kurshinska and G. E. Kudlya 6 Oct. 1987 12 p Transl. into ENGLISH from Pribory i Sistemy Upravleniya (USSR), no. 3, Apr. 1972 p 51
(AD-A185898; FTD-ID(RS)T-0940-87) Avail: NTIS HC A03/MF A01 CSCL 11B

Since from heat-reactive materials lens can be prepared mechanically (prolonged and cumbersome process) or with polymerization in the form then were selected plastic materials and most productive and cheapest method of treatment/processing thermoplasts - press casting. For preparing lens by press casting one should use large injection pressure. Based on this, for the experiments the casting machine (WH-63) with the piston plastification of material and the maximum pressure was used. For testing optical and physicomechanical properties of materials samples of following forms were selected: plane parallel prism and right angled plate for experiments were used the Soviet transparent thermoplasts. GRA

N88-15070# Lehigh Univ., Bethlehem, Pa.
GROUP CONTRIBUTION ANALYSIS OF THE DAMPING BEHAVIOR OF HOMOPOLYMERS, STATISTICAL COPOLYMERS AND INTERPENETRATING POLYMER NETWORKS BASED ON ACRYLIC, VINYL AND STYRENIC MERS
M. C. Chang, D. A. Thomas, and L. H. Sperling 1987 40 p
(Contract N00014-84-K-0508)
(AD-A185904) Avail: NTIS HC A03/MF A01 CSCL 11C

The integral of the loss modulus versus temperature plots in the vicinity of the glass transition temperature (loss area, LA) was characterized for various homopolymers, statistical copolymers and interpenetrating polymer networks, (IPN's), based on acrylics, vinyls, and styrenic mers. The quantity LA was found to be a molecular characteristic, governed by the structure of the individual mers. The Loss area of both IPN's and statistical copolymers obeys an additive relation of the component polymers. A group contribution analysis for LA was developed, in which each moiety contributes a specific value to LA. A table derived via this group contribution analysis permits the prediction of LA values. The results show that backbone motions and the moieties attached directly to the backbone contribute the most to the damping peak, and that long side chains act as diluents. GRA

N88-15071# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF OBTAINING OF FIRE RESISTANT POLYACRYLONITRILE FIBER OR CLOTH FROM IT
V. Ye. Kotina, A. A. Konkin, and H. M. Kosova 26 Aug. 1987 9 p Transl. into ENGLISH of Russian Patent no. 138324 (17 Nov. 1966) p 1-2
(AD-A185941; AD-F000114; FTD-ID(RS)T-0614-87) Avail: NTIS HC A02/MF A01 CSCL 11E

A fire resistant polyacrylonitrile fiber is obtained by heating to 200 C; however, a fiber with the low strength characteristics is obtained. A method is proposed for obtaining a fire resistant polyacrylonitrile fiber or cloth from it. The polyacrylonitrile fiber is subjected in stages to hot working, heating initially at 200 C during 25-30 h. The temperature is raised further to 200 C with a velocity of 1.5-2.0 in 1 min. After reaching 300 C the temperature is raised to 400-475 during 15-25 min. In this case fire resistant material with good mechanical properties is obtained. The processed polyacrylonitrile cloth is not ignited in the flame of burner and has the following strength characteristics: weight 1 sq. m.-200 g; strength on base 38-45 rkm, on the weft 30-35 rkm; elongation on the base and on weft 4-5 percent. B.G.

N88-15072# Army Belvoir Research and Development Center, Fort Belvoir, Va.
DEVELOPING AN ACCELERATED ENDURANCE TEST FOR GREASES: A STATUS REPORT Interim Report
In-Sik Rhee Aug. 1987 29 p
(AD-A185963; AD-F000114; BRDEC-2453) Avail: NTIS HC A03/MF A01 CSCL 11H

The objective of this study was to develop a grease endurance test method which can be utilized in the comprehensive test methodologies being developed for predicting the performance life of military grease under laboratory environment. In an initial study, the ASTM D3527 test method, Life Performance of Automotive Wheel Bearing Grease has been evaluated because it is supposedly simulating an operating environment and has widespread applications. The results show that this method has poor precision, long-endurance test time and poor simulation of field conditions. In particular, the termination criteria used in this method tend to extend grease life. To solve the problem, tentative termination criteria were developed based on the softening of grease, which reduced the test time and distinguished between a good and a poor grease as well as the current method is able to do. To define the L10 life of MIL-G-10924 grease, baseline tests were conducted using the ASTM D3527 method. The L10 life of this grease is less than 20 h. Such a grease is not satisfactory in military vehicles with wheel bearings that are equipped with disc brakes. GRA

N88-15073# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
STRUCTURE-PROPERTY RELATIONSHIPS IN THERMOPLASTIC ELASTOMERS 4. DYNAMIC MECHANICAL RELAXATIONS IN POLY(DIOXOLANE), POLY(BUTYLTRIOXOCANE) AND POLY-(PROPYLENE OXIDE) POLYURETHANES
James C. Chen and M. K. Rho 15 Aug. 1987 30 p
(Contract N00014-85-K-0880)
(AD-A186278; TR-23) Avail: NTIS HC A03/MF A01 CSCL 11J

Dynamic mechanical measurements had been made on polyurethanes of a range of hard segment content (HSC) obtained form alpha, omega-dihydroxy derivatives of poly(propylene oxide) of 2000 to 12,000 MW coupled with MDI and TDI with hydroxyethyl phthalamide chain extenders. N-methylated chain extender was used to investigate the effect of hydrogen bonding. A board gamma transition was observed between - 100 deg and -115 deg attributable to the local motion of methylene sequences with a distribution of relaxations. The B transition between -55 deg and -72 deg is influenced by the degree of hydration; the a transition occurs at nearly the same temperatures for all the TPE's independent of HSC and thermal history. The magnitude of the loss tangent peak corresponds to the glass transition. An alpha transition at higher temperature is sensitive to the structure of soft segment, HSC and thermal history. GRA

N88-15074# Office of Naval Research, London (England).
ASSESSMENT OF ELECTROCERAMICS RESEARCH IN EUROPE AND THE MIDDLE EAST
Robert W. Vest 18 Sep. 1987 6 p
(AD-A186377; ONRL-7-028-R) Avail: NTIS HC A02/MF A01 CSCL 09A

European and Middle Eastern research in microelectronics is discussed under four topic areas: dielectrics, sensors, hybrid microelectronics, and non-conventional processing. GRA

N88-15075# Technische Univ., Brunswick (West Germany). Naturwissenschaftlichen Fakultaet.
ELEMENTARY FLUORINATION OF POLYMERS Ph.D. Thesis [ELEMENTARFLUORIERUNG VON POLYMEREN]

Helge Braun 1986 182 p In GERMAN
(ETN-88-90812) Avail: NTIS HC A09/MF A01

The elementary fluorination of polymeric films and macroporous ion exchangers on the basis of polystyrol, latticelike-polymerized with divinylbenzol, was investigated as gas-solid body reaction. The fluorination of macroporous, sulfuric-acid polystyrol resins shows that the pure acid form is less suitable, while the metal-ion-exchanged resins give good results. The fluorination of these resins requires low temperatures and fluorine concentrations. The obtained fluorination degree depends strongly on the nature of the exchanged metal ions. A complete perfluorination of the matrix is difficult to obtain. A high mechanical stability of the fluorinated catalyst is reached with highly latticed resins. The fluorination of macroporous anion exchangers requires comparably mild fluorination conditions. The fluorination of nonporous polymeric films requires more drastic fluorination conditions, but is possible, in contrast with data in the literature. ESA

N88-15076# Ecole Centrale de Lyon (France).
BEHAVIOR OF METAL CERAMIC INTERFACES Final Report [COMPORTEMENT DINTERFACES METAL CERAMIQUES]
C. Beraud, M. Courbiere, C. Esnouf, G. Fantozzi, and G. Thollet 1985 30 p In FRENCH; ENGLISH summary
(PB87-147500) Avail: NTIS HC E04/MF E04 CSCL 11B

It is necessary for numerous industrial applications to create ceramic metal bonds. At this time, if technological solutions exist, they are difficult, insufficient or frequently not viable because of unawareness of the basic mechanisms which are responsible for optimal bonds. It is proposed therefore to implement in this contribution strictly metal ceramic interfaces in the solid state, and then to examine them as meticulously as possible from a point of view of mechanical and structural resistance, especially by transmission electron microscopy. It will then be possible to evolve the essential parameters to be taken into account to understand the behavior of a ceramic metal interface. Author

N88-15077*# Boeing Aerospace Co., Seattle, Wash.
CHROMIC ACID ANODIZING OF ALUMINUM FOIL Final Report
H. Dursch Jan. 1988 40 p
(Contract NAS1-18224)
(NASA-CR-178417; NAS 1.26:178417) Avail: NTIS HC A03/MF A01 CSCL 11C

The success of the Space Station graphite/epoxy truss structure depends on its ability to endure long-term exposure to the LEO environment, primarily the effects of atomic oxygen and the temperture cycling resulting from the 94 minute orbit. This report describes the development and evaluation of chromic acid anodized (CAA) aluminum foil as protective coatings for these composite tubes. Included are: development of solar absorptance and thermal emittance properties required of Al foil and development of CAA parameters to achieve these optical properties; developing techniques to CAA 25 ft lengths of Al foil; developing bonding processes for wrapping the Al foil to graphite/epoxy tubes; and atomic oxygen testing of the CAA Al foil. Two specifications were developed and are included in the report: Chromic Acid Anodizing of Aluminum Foil Process Specification and Bonding of Anodized Aluminum Foil to Graphite/Epoxy Tubes. Results show that CAA Al foil provides and excellent protective and thermal control coating for the Space Station truss structure. Author

N88-15078# Argonne National Lab., Ill.
DIFFRACTION BY GLASSES WITH A LAYER STRUCTURE
A. C. Wright, D. L. Price, A. G. Clare, G. Etherington, and R. N. Sinclair Jun. 1987 12 p Presented at the 2nd International Conference on the Effects of Modes of Formation on the Structure of Glasses, Nashville, Tenn., 16 Jun. 1987 Prepared in cooperation with Reading Univ. United Kingdom and United Kingdom Atomic Energy Authority, Harwell
(Contract W-31-109-ent-38)
(DE88-003059; CONF-8706151-2) Avail: NTIS HC A03/MF A01

An outline is presented of the expected form of the diffraction pattern and the real space correlation function for a glass with a layer structure. The diffraction evidence for and against the presence of layers in the structure of the vitreous arsenic and germanium chalcogenides is briefly reviewed with special reference to the outrigger raft model for vitreous GeSe2. DOE

N88-15079# Argonne National Lab., Ill.
A COMPARISON OF FILM-BASED TOMOGRAPHY AND COMPUTED TOMOGRAPHY FOR ADVANCED CERAMIC MATERIALS
W. A. Ellingson, M. W. Vannier, and R. J. Kriz Jun. 1987 21 p Presented at the 16th Symposium on Nondestructive Evaluation, San Antonio, Tex., 21 Apr. 1987
(Contract W-31-109-eng-38)
(DE88-003114; CONF-8704231-1) Avail: NTIS HC A03/MF A01

An x-ray computed tomography (CT) imaging system and an analog tomographic system were used to examine a green-state Si3N4 test specimen. The CT system used was a state-of-the-art medical CT scanner with a polychromatic source. The film-based tomography system was a Siemens Optiplanimat with tungsten target and 2.5-mm Al filtration. It was operated in one scan pattern. Single-emulsion industrial film was used to increase spatial resolution. Results show that with the equipment and test specimens used, computed tomography is superior in size of defect detectable. DOE

N88-15080# Oak Ridge National Lab., Tenn.
TECHNIQUES FOR CERAMIC SINTERING USING MICROWAVE ENERGY
H. D. Kimrey, M. A. Janney, and P. F. Becher 1987 6 p Presented at the 12th Annual International Conference of the Institute of Electrical and Electronics Engineers on Infrared and Millimeter Waves, Orlando, Fla., 14 Dec. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001416; CONF-871210-1) Avail: NTIS HC A02/MF A01

The use of microwave energy for ceramic sintering offers exciting new possibilities for materials processing. Based on experience gathered in microwave processing associated with the heating of fusion plasmas, we have developed hardware and methods for uniformly heating ceramic parts of large volume and irregular shape to temperatures in excess of 1600 C, in vacuum or pressurized atmosphere. Microwave processing at 28 GHz yields enhanced densification rates with a corresponding reduction in sintering temperatures. DOE

N88-15081# California Univ., Berkeley. Lawrence Berkeley Lab.
DETECTION OF MINIMUM-IONIZING PARTICLES IN HYDROGENATED AMORPHOUS SILICON
S. N. Kaplan, I. Fujieda, V. Perez-Mendez, S. Qureshi, W. Ward, and R. A. Street Sep. 1987 15 p Presented at the Conference on Position-Sensitive Detectors, London, United Kingdom, 7 Sep. 1987 Prepared in cooperation with Xerox Palo Alto Research Center, Calif.
(Contract DE-AC03-76SF-00098)
(DE88-002769; LBL-23961; CONF-8709153-2) Avail: NTIS HC A03/MF A01

Based on previously-reported results of the successful detection of alpha particles and 1- and 2-MeV protons with hydrogenated amorphous silicon (a-Si : H) diodes, detection of a single minimum-ionizing particle will require a total sensitive thickness of approximately 100 to 150 microns, either in the form of a single thick diode, or as a stack of several thinner diodes. Signal saturation at high dE/dx makes it necessary to simulate minimum ionization in order to evaluate present detectors. Two techniques, using pulsed infrared light, and pulsed X-rays, give single-pulse signals large enough for direct measurements. A third, using beta rays, requires multiple-transit signal averaging to produce signals measurable above noise. Signal amplitudes from the a-Si : H limit at 60 percent of the signal size from Si crystals extrapolated to the same thickness. This is consistent with an a-Si : H radiation

ionization energy, W = 6 eV/electron-hole pair. Beta-ray signals are observed at the expected amplitude. DOE

N88-15082*# College of William and Mary, Williamsburg, Va. Dept. of Chemistry.
SPACE ENVIRONMENTAL EFFECTS ON POLYMERIC MATERIALS Semiannual Progress Report, 1 Jun. - 30 Nov. 1987
Richard L. Kiefer and Robert A. Orwoll 15 Feb. 1988 6 p
(Grant NAG1-678)
(NASA-CR-182418; NAS 1.26:182418) Avail: NTIS HC A02/MF A01 CSCL 11B

Polymer-matrix composites have considerable potential for use in the construction of orbiting structures such as the space station and space antennas because of their light weight, high strength, and low thermal expansion. However, they can suffer surface erosion by interaction with atomic oxygen in low-Earth orbit and degradation and/or embrittlement by electrons and ultraviolet radiation especially in geosynchronous orbit. Thus, a study of the effect of these environmental hazards on polymeric materials is an important step in the assessment of such materials for future use in space. Author

N88-15620*# Alabama Univ., Huntsville. Dept. of Chemistry.
USE OF HYDROPHILIC POLYMER COATINGS FOR CONTROL OF ELECTROOSMOSIS AND PROTEIN ADSORPTION
J. Milton Harris *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 8 p (For primary document see Summer Faculty Fellowship Program 8 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11B

N88-15633*# Alabama Univ., Huntsville.
THE DEVELOPMENT OF TEST METHODOLOGY FOR TESTING GLASSY MATERIALS
Dennis S. Tucker *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 21 p (For primary document see Summer Faculty Fellowship Program 21 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11C

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

No abstracts in this category.

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology.*

N88-15083# Vanderbilt Univ., Nashville, Tenn. Center for the Space Processing of Engineering Materials.
CENTER FOR THE SPACE PROCESSING OF ENGINEERING MATERIALS Annual Report No. 2, 1 Nov. 1986 - 31 Oct. 1987
1987 159 p
Avail: NTIS HC A08/MF A01

Project titles, participating company, principle investigators and coinvestigators are listed for the 13 companies who make up the Vanderbilt University Center for Space Processing of Engineering Materials. Each of the projects is described. B.G.

N88-15084# Battelle Inst., Frankfurt am Main (West Germany).
ALLOWABLE GRAVITY-LEVELS FOR SPACELAB, COLUMBUS AND EURECA Final Report
D. Langbein Paris, France ESA Apr. 1987 206 p
(Contract ESA-6726/86-F-FL-(SC))
(BF-R-66.525-2; ESA-CR(P)-2454; ETN-88-91150) Avail: NTIS HC A10/MF A01

The sensitivity of liquid columns to residual accelerations; oscillations of a spherical particle inside an oscillating spherical container; stability of Marangoni flows; critical phenomena; buoyancy effects associated with gravity disturbances; and tolerable g-levels for fluid science experiments in space are discussed. ESA

N88-15355*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASTROPHYSICS AND THE SOLAR NEBULA
Joseph Nuth, Walter Duley, John Goebel, J. Mayo Greenberg, John Kerridge, Douglas Lin, Ian Mackinnon, Frans Rietmeijer, John Stephens, and Martin Tomasko (Arizona Univ., Tucson.) *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 3-9 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 22A

N88-15356*# Arizona State Univ., Tempe.
PLANETARY SCIENCE
John R. Marshall, Frank Bridges, Donald Gault, Ronald Greeley, Harry Houpis, Douglas Lin, and Stuart Weidenschilling (Planetary Science Inst., Tucson, Ariz.) *In* NASA. Ames Research Center, Moffett Field, Calif. Microgravity Particle Research on the Space Station Dec. 1987 p 11-18 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 03B

N88-15357*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ATMOSPHERIC SCIENCE
Patrick Hamill, Thomas Ackerman, Antony Clarke, Jindra Goodman, Zev Levin, Martin Tomasko (Arizona Univ., Tucson.), O. Brian Toon, and Robert Whitten *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 19-24 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 04A

N88-15358*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXOBIOLOGY AND LIFE SCIENCE
C. P. McKay *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 25-27 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 06B

N88-15359*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSICS AND CHEMISTRY
Martin Moskovits, Lou Allamandola, Christopher Becker, Friedemann Freund, M. Freund, P. Haff, Jill Tarter, Otis Walton, David Weitz, and Brad Werner (California Inst. of Tech., Pasadena.) *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 29-34 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 20C

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N88-15085# MMR Technologies, Inc., Mountain View, Calif.
DEVELOPMENT OF A LOW NOISE 10 K J-T REFRIGERATION SYSTEM Final Technical Report
William A. Little 15 Jun. 1987 6 p

(Contract N00014-86-C-0301)
(AD-A186004) Avail: NTIS HC A02/MF A01 CSCL 13A

This report summarizes work done on the development of a low noise Joule-Thompson, microminiature refrigeration system designed for 10 K operation. Topics discussed include: calculation of phase diagram of mixtures of certain hydrocarbon gases with nitrogen using the Benedict-Webb-Rubin equation of state, the set up of a magnetron-enhanced sputtering system to allow us to sputter a layer of adhesive on the glass substrates with a much better defined thickness than can be laid down using the older screen printing method, Redesign of H2 Refrigerator Test Stage, Redesign of Mixed Gas Heat Exchanger, Refrigerator Fabrication, Gas Cleaner. GRA

N88-15086# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
[ACTIVITIES REPORT IN METAL MANUFACTURING] Annual Report, 1986 [RAPPORT ANNUEL DU COMITE PERMANENT AU CONSEIL GENERAL]
15 Jun. 1987 67 p In FRENCH
(ISSN-0524-7705; ETN-88-90730) Avail: NTIS HC A04/MF A01

Research on vermicular graphite and bainitic nodular iron castings, molding sand, solidification numerical simulation, and thermal treatments is described. Developments of metallic constructions of many different types are presented. The manufacturing techniques, the utilization of plastic materials, and surface treatments are discussed. ESA

N88-15087# National Bureau of Standards, Gaithersburg, Md. Center for Fire Research.
CATALOG OF COMPARTMENT FIRE MODEL ALGORITHMS AND ASSOCIATED COMPUTER SUBROUTINES
D. W. Stroup Aug. 1987 204 p
(PB88-110861; NBSIR-87/3607) Avail: NTIS HC A10/MF A01 CSCL 13B

A catalog of available fire model algorithms was assembled to aid in the development of a benchmark compartment fire model. The catalog contains algorithms which calculate various chemical/physical fire phenomena. The description of each algorithm includes the input(s), output(s), and calculations performed. In addition, each algorithm has a computer subroutine written for it in FORTRAN 77. The variables used as input and output throughout the catalog are cross-referenced. This enables the catalog user to determine which routines would be required to calculate a particular fire phenomena. Author

N88-15088# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
SAFETY IMPLICATIONS OF ONBOARD REFUELING VAPOR RECOVERY SYSTEMS Final Technical Report
Jun. 1987 103 p
(PB88-102603; EPA/AA/SDSB-87/05) Avail: NTIS HC A06/MF A01 CSCL 13B

The safety implications of requiring onboard refueling vapor recovery systems on gasoline powered passenger cars, light trucks and heavy duty vehicles are evaluated. Special attention is given to the analysis of the design considerations for a safe onboard system and other measures necessary to insure that the design considerations incorporated are capable of providing a high level of in-use fuel system integrity. Concerns over the potential safety implications of onboard systems were raised. These concerns can be grouped into 4 areas. These include requirements to pass the National Highway Traffic Safety Administration safety test, the effects of tampering and system defects, refueling operations, and in-use fuel system safety. All of these concerns are presented as well as design considerations for a safe system. In use fuel system safety is also presented as well as cost and leadtime considerations for implementing a safe system. Author

N88-15089# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
INVESTIGATION OF THE NEED FOR IN-USE DISPENSING RATE LIMITS AND FUEL NOZZLE GEOMETRY STANDARDIZATION
May 1987 23 p
(PB88-102611; EPA/AA/SDSB-87/07) Avail: NTIS HC A03/MF A01 CSCL 13B

The results of the investigation of the effects of dispensing rates and fuel nozzle geometries on motor vehicle refueling emissions are presented. EPA's proposal to regulate in-use dispensing rates are supported and the need for some form of gasoline nozzle standardization is examined. Author

N88-15090# Oak Ridge National Lab., Tenn. Energy Div.
LIFE-CYCLE COST ANALYSIS OF RESIDENTIAL HEAT PUMPS AND ALTERNATIVE HVAC (HEATING, VENTILATING AND AIR-CONDITIONING) SYSTEMS
V. C. Mei and E. A. Nephew Sep. 1987 72 p
(Contract DE-AC05-84OR-21400)
(DE88-003701; ORNL/TM-10449) Avail: NTIS HC A04/MF A01

A simple methodology is presented for calculating the life-cycle cost of a residential heat pump, an electric furnace with a central air conditioner, and a gas furnace with a central air conditioner. The procedure described in this report involves application of the Annual Performance Factor computer model developed by the Oak Ridge National Laboratory. This model was used to calculate the annual energy consumption of each of the three systems for 117 different climatic locations within the United States for residential buildings of varying sizes and insulation levels. Nine example calculations are included in the report to better explain the calculational procedure. These examples show that the life-cycle costs of the residential heat pump are somewhat higher than those of the gas furnace with central air conditioner. However, the cost advantage of the gas-fired system is not decisive and could disappear in locations having low power costs or if relative fuel prices change. DOE

N88-15091# Yamagata Univ. (Japan).
BULLETIN OF THE YAMAGATA UNIVERSITY (ENGINEERING), VOLUME 20, NO. 1, JANUARY 1988
Jan. 1988 138 p In ENGLISH and JAPANESE
(ISSN-0085-834X) Avail: NTIS HC A07/MF A01

Papers addressing various topics in electrical, mechanical, and chemical engineering and information science are compiled. Specific subjects include: structural relaxation and mechanical properties in amorphous alloys, equivalent mechanical circuits for resonant vibrators, calculation of the terminal velocity of falling snowflakes, constitution of coal liquifaction solvents, chemical synthesis of ruthenocenophane, and a chemical substance name retrieval system. For individual titles, see N88-15092 through N88-15094.

N88-15092# Yamagata Univ. (Japan). Dept. of Electrical Engineering.
EQUIVALENT CIRCUIT CONSIDERATION ON THE ROTATION OF RESONANT MODES OF DOUBLE RESONANT VIBRATORS **c37**
Konno Masashi, Yamayoshi Yasuhiro, Sugawara Sumio, and Tomikawa Yoshiro *In its* Bulletin of the Yamagata University (Engineering), Volume 20, No. 1, January 1988 Jan. 1988 p 1-11 In JAPANESE; ENGLISH summary (For primary document see N88-15091 07-31)
Avail: NTIS HC A07/MF A01

Equivalent mechanical circuits for the rotating motion and the rotation of resonant modes in a double resonant vibrator are given. It is pointed out that the equivalent circuit for the double resonant vibrator separating the degeneration is different from the one for the degenerate double resonant vibrator. An analysis on the rotating motion of the double resonant cantilever is presented and the approximate equivalent mechanical circuits of ultrasonic motors are described. Author

N88-15093# Yamagata Univ. (Japan). Dept. of Electrical Engineering.
ANALYSES BY EQUIVALENT MECHANICAL CIRCUITS OF BENDING VIBRATION BARS WITH LOAD-IMPEDANCE AT ONE END **c39**
Konno Masashi, Yamayoshi Yasuhiro, Nakamura Hisashi, and Oyama Shigeru *In its* Bulletin of the Yamagata University (Engineering), Volume 20, No. 1, January 1988 Jan. 1988 p 13-26 In JAPANESE; ENGLISH summary (For primary document see N88-15091 07-31)
Avail: NTIS HC A07/MF A01

The equivalent mechanical circuits for bending vibration bars with load-impedance at one end are given. The equivalent circuits are determined by the expansion method of normalized modes of the resonant vibration bar. The effective resonance frequency constant (alpha sub e) and the effective equivalent mass (m sub e) or inertia (I sub e) are calculated by the circuit considering only lower resonant modes, and these values are compared with the exact values. Author

N88-15094# Yamagata Univ. (Japan). Section of Technology.
STRUCTURAL RELAXATION AND MECHANICAL PROPERTIES OF AMORPHOUS Fe-Zr ALLOYS **c26**
Nasu Toshio, Nagaoka Kunio, Yoshida Hiroaki, Ajiki Isao, and Suganuma Eiichi *In its* Bulletin of the Yamagata University (Engineering), Volume 20, No. 1, January 1988 Jan. 1988 p 43-50 In JAPANESE; ENGLISH summary (For primary document see N88-15091 07-31)
Avail: NTIS HC A07/MF A01

Electrolytic iron and zirconium were melted in an arc furnace. The alloy was remelted by heating in a high frequency coil and then quenched directly on to a rotating roller. This whole process was performed in a vacuum vessel which was kept at 600 mm Hg with an argon atmosphere introduced after prior evacuation to 5 x 10(-5) torr. Differential thermal analysis (DTA) was carried out for six different compositions. Amorphous samples were heated at a temperature of 650 C for 30 min to generate the structural relaxation. X-ray diffraction measurements with a Mo-K alpha source were carried out for the amorphous samples and the crystallized samples, and then compared with the results of DTA analysis. Mechanical properties of amorphous samples were compared with those of crystallized samples. It was found that the crystallization temperatures of the amorphous alloys are distributed in the range of 570 to 610 C. The crystallization process included two stages. In the first stage of the relaxation process, alpha-Fe was formed. In the second stage, Fe3Zr was formed. The tensile strength and elongation properties of amorphous state samples were much greater than those of crystallized samples. Author

N88-15095# Lawrence Livermore National Lab., Calif.
DIAMOND TURNING OF SILICON FOR OPTICS APPLICATIONS
J. S. Taylor, C. K. Syn, R. R. Donaldson, and S. R. Patterson Sep. 1987 12 p
(Contract W-7405-eng-48)
(DE88-002501; UCID-21187) Avail: NTIS HC A03/MF A01

The goal of this study is to examine the feasibility of fabricating silicon optical surfaces by diamond turning. Our approach has been to machine small slices of single crystal silicon using a range of process parameters similar to what has typically been employed with ductile materials. In this manner, a set of conditions has been bracketed which has yielded good values of surface finish as measured by stylus profilometry, and low levels of surface damage as indicated by scanning electron microscopy. The surfaces generated thus far have also yielded information of a fundamental nature which relates to the turning of brittle materials in general. Recommendations for further work are suggested to maximize the material removal rate without compromising surface quality, to quantify any tendency to generate figure errors, and determine what problems are involved in scaling the process to larger surfaces. DOE

N88-15096# Department of Energy, Washington, D. C. Engineering and Geosciences Div.
SUMMARIES OF FY 1987 ENGINEERING RESEARCH
Nov. 1987 127 p
(DE88-002572; DOE/ER-0352) Avail: NTIS HC A07/MF A01

The Basic Energy Sciences (BES) Engineering Research program for fiscal year 1987 is presented; a summary is provided for each of the program projects in addition to a brief program overview. The report is intended to provide staff of Congressional committees, other executive departments, and other DOE offices with substantive program information so as to facilitate governmental overview and coordination of Federal research programs. Of equal importance, its availability facilitates communication of program information to interested research engineers and scientists. DOE

N88-15626*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
COMPUTER-AIDED ANALYSIS FOR THE MECHANICS OF GRANULAR MATERIALS (MGM) EXPERIMENT, PART 2
Joey K. Parker *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 25 p (For primary document see Summer Faculty Fellowship Program 25 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 13B

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N88-15097# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SPEECH RECOGNITION: ACOUSTIC-PHONETIC KNOWLEDGE ACQUISITION AND REPRESENTATION Annual Progress Report, 1 Jul. 1986 - 30 Jun. 1987
Victor W. Zue 25 Sep. 1987 368 p
(Contract N00014-82-K-0727)
(AD-A185897) Avail: NTIS HC A16/MF A01 CSCL 17B

The annual report on speech recognition contains the following: Models of Phonetic Recognition: The Role of Analysis by Synthesis in Phonetic Recognition; The Influence of Phonetic Context on the Acoustic Properties of Stops; The Role of Syllable Structure in the Acoustic Realizations of Stops; A Semivowel Recognition System; Two-Dimensional Characterization of the Speech Signal and Its Potential Applications to Speech Processing; An Acoustic-Phonetic Approach to Speech Recognition: Application to the Semivowels (Thesis); Recognition of Words from their Spellings: Integration of Multiple Knowledge Sour. GRA

N88-15098# Naval Postgraduate School, Monterey, Calif.
AN APPROACH TO VALIDATION AND VERIFICATION OF THE COMMUNICATIONS LOAD MODEL WITH SUPPORTING USER'S GUIDE M.S. Thesis
William R. Cox Sep. 1987 125 p
(AD-A185926; AD-F000114) Avail: NTIS HC A06/MF A01 CSCL 17B

This thesis investigates the issues of validation and verification of the Communications Load Model (CLM) being used in the Battle Group Communications Simulation Facility at the Naval Air Development Center. The processes involved in creating user input files are explained and evaluated. A user's guide is included to assist the user in interpreting input into the proper data structure and format for use by the model. Structure and function of the model and its components are examined. Calculations of results predicted by scenario inputs are compared to actual program

output. The analysis is used to determine appropriate methodology to be utilized in validation and verification of the CLM. GRA

N88-15099# Lancaster Univ. (England). Dept. of Environmental Sciences.
EISCAT (EUROPEAN INCOHERENT SCATTER RADAR) ELECTRON DENSITY STUDIES Final Report, 17 Aug. 1986 - 17 Aug. 1987
Christopher J. Burns and John K. Hargreaves 8 Sep. 1987 47 p
(Grant AF-AFOSR-0295-86)
(AD-A185998; EOARD-TR-87-08) Avail: NTIS HC A03/MF A01 CSCL 04A

The study of F-region electron density irregularities has continued and further runs of the Special Program have been scheduled to coincide with overpasses of the HILAT satellite. Programming improvements have led to more effective analysis of the data from both EISCAT and HILAT observations. Major variations in electrons in electron content are shown to be related to well defined enhancements of electron density. Typical periods range between 35 and 200 seconds, imply spatial structures of 12 to 70 km. These variations would have significant effects on transionospheric radio propagation. Preliminary comparisons have been made between EISCAT and HILAT measurements of total electron content. A significant difference between the measurements is observed, the HILAT observations being 2.2 times larger than those derived from EISCAT. The HILAT measurements from the December 1985 appear to be too large. A brief description is given of the first run of the Special Program on the VHF radar. GRA

N88-15100# Naval Research Lab., Washington, D.C.
CAGE MODE PROPAGATION EXPERIMENTS Interim Report, Jan. 1983 - Sep. 1985
M. Raleigh and R. F. Fernsler 15 Sep. 1987 21 p
(AD-A186019; NRL-MR-5784) Avail: NTIS HC A03/MF A01 CSCL 20C

Several experiments have been performed wherein an electron beam is propagated inside an array of four parallel conducting rods which form the long sides of a slender box. The electron beam is injected at one small face of the box and the other small face is the beam dump. This configuration is referred to as a cage. Various combinations of parallel and angled injection of the beam, metal and resistive rods, and different background pressures of Nitrogen were tried. Diagnostics included still photography, a beam current monitor at the injection point, and a net current monitor at the beam dump. The effect of the cage was always to restrict hose motion and enhance beam transport. GRA

N88-15101# Naval Research Lab., Washington, D.C.
TEXTURE STUDY OF SYNTHETIC APERTURE RADAR (SAR) IMAGES OF OCEAN SURFACES Interim Report
Li-Jen Du 20 Aug. 1987 29 p
(AD-A186021; NRL-MR-6005) Avail: NTIS HC A03/MF A01 CSCL 17I

This report describes the first phase of a study whose objective is to establish the relation between the texture in SAR images of the ocean surface and the relevant physical conditions giving rise to this texture. The initial concern is the selection of a technique which leads to a reliable separation of images into regions of different texture. Section 2 of the report discusses the role of texture in image analysis. Section 3 introduces the concept of a feature and establishes rationale for the selection of gray level co-occurrence matrix approach to feature extraction. Section 4 describes the proposed classification algorithm and Section 5 gives the results for several test images. It is found that this approach works will in classification of land scenes. For ocean images which exhibit only subtle differences between regions the approach's discriminating power is less satisfactory than for land scenes. In Section 6 alternate approaches are suggested for ocean images. GRA

N88-15102# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.
A MULTI USER RANDOM ACCESS COMMUNICATION SYSTEM FOR USERS WITH DIFFERENT PRIORITIES Annual Technical Report, 1 Jan. - 31 Dec. 1986
D. Kazakos and I. Stavrakakis 28 Feb. 1987 33 p
(Grant AF-AFOSR-0030-82)
(AD-A186041; UVA/525656/EE87/102; AFOSR-87-1047TR)
Avail: NTIS HC A03/MF A01 CSCL 17B

A multi user random access communication system with a population of two classes of users is considered. It is assumed that packets generated by users from different classes have different priorities. Fast moving users in a mobile communication system, or high priority users in a static environment, might be members of the high priority class. A binary feedback collision resolution algorithm is developed and both throughput and delay analysis are performed. Analytical results show that for the operation region of practical interest, the high priority class experiences significantly shorter delays, compared to the low priority one which maintains good delay characteristics. Author (GRA)

N88-15103# Michigan Univ., Ann Arbor. Communications and Signal Processing Lab.
PERFORMANCE ANALYSIS OF CODED FREQUENCY-HOPPED SPREAD-SPECTRUM SYSTEMS WITH UNKNOWN INTERFERENCE
M. V. Hedge Aug. 1987 117 p
(Contract N00014-85-K-0545)
(AD-A186069; Rept-022793-3-T; TR-250) Avail: NTIS HC A06/MF A01 CSCL 17D

Two classes of problems are considered. In the first class we model the process of communicating in the presence of interference, which is unknown or hostile, as a two-person zero sum game with the communicator and the jammer as the players. The objective functions we consider are mutual information and the channel cutoff rate. The communicator's strategies are distributions on the input alphabet and on a set of quantizers and the jammer's strategies are distributions on the noise power subject to certain constraints. We consider various conditions on the jammer's strategy set and on the communicator's knowledge. For the case with the decoder uninformed of the actual quantizer chosen, we show that, from the communicator's perspective the worst-case jamming strategy is a distribution concentrated at a finite number of points thereby converging a functional optimization problem into a nonlinear programming problem. Moreover, we are able to also characterize the worst-case distributions by means of necessary and sufficient conditions which are easy to verify. For the case with the decoder informed of the actual quantizer chosen we are able to demonstrate the existence of saddle-point strategies. GRA

N88-15104# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.
PACKET ERROR PROBABILITIES IN FREQUENCY-HOPPED SPREAD SPECTRUM PACKET RADIO NETWORKS. MARKOV FREQUENCY HOPPING PATTERNS CONSIDERED
M. Georgiopoulos and P. Kazakos 18 Sep. 1987 31 p
(Contract N00014-86-K-0742)
(AD-A186071; UVA/525415/EE88/108) Avail: NTIS HC A03/MF A01 CSCL 17B

We compute the packet error probability induced in a frequency-hopped spread spectrum packet radio network, which utilizes first order Markov frequency hopping patterns. The frequency spectrum is divided into q frequency bins and the packets are divided into M bytes each. Every user in the network sends each of the M bytes of his packet at a frequency bin, which is different from the frequency bin used by the previous byte, but equally likely to be any one of the remaining q-1 frequency bins (Markov frequency hopping patterns). Furthermore, different users in the network utilize statistically independent frequency hopping patterns. Provided that, K users have simultaneously transmitted their packets on the channel, and a receiver has locked on to

one of these K packets, we present a method for the computation of P sub e (K) (i.e. the probability that this packet is incorrectly decoded). Furthermore, we present numerical results (i.e. P sub e (K) versus K) for various values of the multiple access interference K, when Reed Solomon (RS) codes are used for the encoding of packets. Finally, some useful comparisons, with the packet error probability induced, if we assume that the byte errors are independent, are made; based on these comparisons, we can easily evaluate the performance of our spread spectrum system. GRA

N88-15105# Michigan Univ., Ann Arbor. Communications and Signal Processing Lab.

CHANNEL ACCESS PROTOCOLS FOR MULTIHOP PACKET RADIO NETWORKS Technical Report, Oct. 1985 - Oct. 1986

Si-Taur Wang Nov. 1986 136 p

(Contract N00014-85-K-0545)

(AD-A186074; Rept-022793-1-T; TR-242) Avail: NTIS HC A07/MF A01 CSCL 17B

We first introduce two laws which if obeyed will ensure that nodes will not interfere with one another's transmissions. We then apply these laws to the regular planar networks, i.e., the triangular, square, and hexagonal networks, and place bounds on the capacities that can be achieved by protocols obeying the laws. We also demonstrate that there exist protocols obeying one of the laws which are optimal, optimal in the sense that no other protocol similarly constrained has greater capacity. Next, we show that the application of these laws leads to new random, access protocols for multihop packet radio networks. The first of these is a class called the TREE/TDMA protocols in which two level of control are used on a shared channel: the TREE Protocol is used by nodes to feed a regular backbone of repeaters which uses avoidance, multiple access protocol (CS/CAMA) in which a single level of control used on a shared channel and in which the spatial reuse of the channel is maximized. Analytical and simulation models of the protocols are described and are used to evaluate their operating characteristics. Stability criteria, capacities, and mean packet delay times are all analyzed. We conclude the new protocols are efficient, reliable, flexible, and require hardware and software of modest complexity. Both protocols are described and are used to evaluate their operating characteristics. Stability criteria, capacities, and mean packet delay times are all analyzed. GRA

N88-15106# Parametrics, Inc., Waltham, Mass.

ABSORPTION, SCATTERING, AND THERMAL RADIATION BY CONDUCTIVE FIBERS Final Report, 16 May 1984 - 15 Jan. 1987

N. E. Pedersen, P. C. Waterman, and J. C. Pedersen 16 Jul. 1987 125 p

(Contract F49620-84-C-0045)

(AD-A186105; AFOSR-87-1261TR) Avail: NTIS HC A06/MF A01 CSCL 11B

The scattering of electromagnetic waves using variational methods was studied. The work can be regarded as an extension of previous work and includes both finite conductivity and arbitrary angle of incidence. Differential scattering patterns are then computed, along with the scattering, absorption and extinction. These cross sections are obtained by intergrating the normal component of the Poynting vector over the surface of the fiber, enabling us to avoid the integration over the far-field sphere usually employed to compute scattering. In addition, it is found that energy considerations are exactly satisfied: the extinction cross section, which by the optical theorem must equal the imaginary part of the forward amplitude, is identically equal to the sum of the absorption and scattering cross sections. This result is particularly valuable for those applications in which we study the scattering and absorption properties of the cloud of such fiber particles. GRA

N88-15107# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

A GENERALIZATION OF ORDER STATISTIC FILTERS: THE ALPHA-TRIMMED LINEAR FILTER M.S. Thesis

Douglas B. Rider 1987 190 p

(AD-A186125; AFIT/CI/NR-87-101T) Avail: NTIS HC A09/MF A01 CSCL 17B

With the increase in use of digital communications has come a renewed interest in nonlinear filtering techniques. In some signal processing applications the suppression of noise on a discrete-time signal sequence can not be adequately accomplished using linear filtering. In order to preserve sharp edges in a signal while still smoothing noise and removing impulsive components requires some type of nonlinear or adaptive filtering. The most common nonlinear smoother to be investigated is the median filter. In this filter the median is taken from a finite length window of values surrounding the input value. This scheme has been shown to preserve edges in signals with a minimum of distortion and is resistant to outliers in the data. However, it often does not provide adequate smoothing of noise that is not by nature impulsive. Yet the desirable properties of median filtering make it worth investigating. GRA

N88-15108# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.

ON THE APPROXIMATION OF THE OUTPUT PROCESS OF MULTI-USER RANDOM ACCESS COMMUNICATION NETWORKS

I. Stavrakakis and D. Kazakos 1 Jun. 1987 34 p

(Grant AF-AFOSR-0095-87)

(AD-A186197; UVA/525677/EE87/102; AFOSR-87-1294TR)

Avail: NTIS HC A03/MF A01 CSCL 17B

A lot of work has been done towards the direction of developing communication protocols that determine how a single common resource can be efficiently shared by a large population of users. By now, it is well known that fixed assignment techniques are not appropriate for a system with large population of bursty users. In the latter case, random access protocols are more efficient and many of them have been suggested. Usually, the amount of information transmitted per time is of fixed length, called a packet. In most of the systems, time is divided into slots of length equal to the time needed for a packet transmission (slotted systems). The deployment of an ever increasing number of multi-user random access communication networks, brought up the question of how packets whose destination is another network, should be handled. Thus, the issue of network interconnection or multi-hop packet transmission, arises, 3, 6, 7. The basic problem in analyzing interconnected systems is that of characterizing the output process of a multi-user random access communication system; i.e., the departure process of the successfully transmitted packets. GRA

N88-15109# Alabama Univ., Huntsville.

RELIABILITY AND SURVIVABILITY OF COMMUNICATION NETWORKS Annual Report

Peter J. Slater, Ashok T. Amin, and Kyle T. Siegrist Aug. 1987 6 p

(Contract N00014-86-K-0745)

(AD-A186248) Avail: NTIS HC A02/MF A01 CSCL 17B

We assume that we have an (n,m)-graph with n vertices and m edges, representing a communications network with each vertex representing a processor and each edge a communications link. We have begun our work by concentrating on the cutting number/pair-connected reliability measure and have initially assumed that each vertex will always remain operable and that each edge has the same probability of failure q. Thus, p=1-q is the probability that any given edge is operable. A standard measure of system reliability is the probability that the graph remains connected. This is denoted by P(G;q), and the probability that a specified pair s and t of vertices is connected is denoted by Ps,t(G;q). The cutting number/pair-connected measure refines the connectivity reliability measure by considering the varying effects of different cutsets. GRA

N88-15110# Naval Postgraduate School, Monterey, Calif.
MEASURED NOISE PERFORMANCE OF A DIRECT-SEQUENCE SPREAD-SPECTRUM SYSTEM AND A COMPARISON OF SINGLE VICE DUAL-CHANNEL DELAY-LOCK LOOPS M.S. Thesis
Chris G. Bartone Sep. 1987 104 p
(AD-A186288) Avail: NTIS HC A06/MF A01 CSCL 17B

A direct-sequence (DS) spread spectrum system which could be used by a conventional amplitude modulated (AM) radio system was designed, built and tested. A delay-lock loop was used to provide code synchronization in the receiver. The noise performance of single-channel delay-lock loop (SCDLL) was compared with a dual channel delay lock loop (DCDLL) with no data being transmitted. When data was transmitted a DCDLL was used and the noise performance (probability of bit error) of the DS spread spectrum system was measured. Test results indicate that SCDLL performs as well as or better than the DCDLL. The measured noise performance advantage relative to the DCDLL and that this DS spread spectrum can be used to transmit low rate digital data reliably at values of SNR much than unity. It is recommended that this DS spread spectrum system be considered by the Department of Defense to be implemented in AM radio system to provide low data rate-anti-jam-interference rejection capability. GRA

N88-15111# Mitre Corp., Bedford, Mass.
OVERESTIMATION OF ON-AXIS POWER DENSITY BY THE FRAUNHOFER (FAR-FIELD) APPROXIMATION Final Report
Melvin M. Weiner Apr. 1987 25 p
(Contract F19628-86-C-0001)
(AD-A186399; MITRE-M87-37; ESD-TR-87-234) Avail: NTIS HC A03/MF A01 CSCL 20C

The overestimation of power density by the Fraunhofer (far-field) approximation to the more exact Fresnel (near-field) diffraction integral is determined as a function of Fresnel number at arbitrary on-axis field points for rectangular and circular aperture illuminations of uniform amplitude and phase. For square and circular apertures, the overestimation is 2.8 percent and 1.3 percent, respectively, at a Fresnel number of 1/8 (corresponding to the far field boundary distance 2D-sq/lambda) and 518 percent and 147 percent, respectively, at a Fresnel number of 1. GRA

N88-15112# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ROUND TABLE ON THE FUTURE OF SATELLITE COMMUNICATIONS AND BROADCASTING IN EUROPE
P. Bartholome and W. R. Burke, ed. Paris, France ESA Aug. 1987 69 p
(ESA-STR-221; ISSN-0379-4067; ETN-88-90916) Copyright Avail: NTIS HC A04/MF A01

Organizations that operate or intend to operate satellite systems for telecommunications or broadcasting in Europe (Eutelsat, Telecom 1, ASTRA, Italsat, DFS/Kopernikus, Tele-X, TV-Sat, TDF 1, Olympus/SARIT) explained the reasons that motivated them to set up a network, the services provided, and gave their views on the future of satellites in Europe. Apart from ASTRA, whose motivations were clearly market oriented right from the start, all projects were launched for reasons other than the desire to satisfy a definite requirement in term of new service offerings. However, all organizations are now focusing on distribution of television programs to the public, either directly or via cable networks. The exceptions are TELE-X, which places higher expectations on the success of business services, and Italsat concentrates on advanced-technology and hopes to make a breakthrough in conventional communications. ESA

N88-15113# Saab-Space A.B., Linkoeping (Sweden).
PACKET TELECOMMAND. SYSTEM PERFORMANCE ASSESSMENT STUDY Final Report
Bertil Linder, Per Appelquist, Maurice Bonfre, Torbjoern Hult, Mats Nilsson, and Karl Waltersson Paris, France ESA Apr. 1987 138 p
(Contract ESTEC-5784/83-NL-PP(SC))
(PTC/TNOT/0015/SAAB; ESA-CR(P)-2446; ETN-88-91143)
Avail: NTIS HC A07/MF A01

The analysis and definition of the on-board segment of a packet telecommand system and the design, manufacturing, and test of a decoder and a central terminal unit (CTU) to handle the specified protocols are described. The telecommand system provides a data management service; data routing service; and a channel service. The packet telecommand-CTU consists of bus controller, simple telemetry generator, bus communication module, and processor/local memory module. Decoder testing and CTU testing show satisfactory results. ESA

N88-15114# INTECS Toscana s.r.l., Pisa (Italy).
STUDY OF COMMUNICATION OPTIONS IN A DISTRIBUTED DATA HANDLING SYSTEM AND SURVEY OF ADVANCED MAN MACHINE COMMUNICATIONS SCHEMES. WORK PACKAGE 1: INTERPROCESS COMMUNICATION Final Report
Paris, France ESA Apr. 1987 65 p
(Contract ESTEC-6653/86-NL-PP(SC))
(ESA-CR(P)-2447; ETN-88-91144) Avail: NTIS HC A04/MF A01

Architectural choices related to the design and development of a network operating system (NOS), supporting a high performance, on-board distributed data handling system (DDHS) compatible with Ada language, were studied. The DDHS is a distributed system consisting of a high bandwidth local area network, connecting a set of nodes. The nodes are microprocessors, or multimicroprocessors. Requirements for a NOS include the provision of a set of standard communication mechanisms and interfaces, for use from DDHS applications, that allow communications among the applications, and sharing of distributed resources. A set of guidelines for the design and the implementation of the kernel and system layers of the NOS was derived. Basic communication mechanisms and protocols were outlined. The detailed design of a prototype implementation of one of the communication mechanisms (remote procedure call mechanism) was completed, and the mechanism was implemented. ESA

N88-15115# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
STUDY OF SYNTHETIC APERTURE RADAR DATA COMPRESSION AND ENCODING. PART 1: SAR IMAGE DATA ANALYSIS Final Report
M. Langemann, J. C. A. vanderLubbe, G. J. L. Nooren, and R. W. Okkes (European Space Agency, Paris, France) Paris, France ESA 1 Oct. 1985 98 p
(Contract ESA-5829/84-NL-BI(SC))
(NLR-TR-85085-L-Pt-1; ESA-CR(P)-2448-Vol-1; ETN-88-91145)
Avail: NTIS HC A05/MF A01

A model to describe the returned voltages of a coherently illuminated radar target was extended to nonhomogeneous targets. The total SAR transfer function in range and azimuth, and two methods for generating artificial SAR images were derived: coherent averaging with (real) spatial and frequency filter respectively. The latter method was implemented as program SPECKL with parameters including number of looks, the signal to (thermal) noise ratio and the weighting in azimuth and range. Quality measures for judging processed radar imagery were reviewed, particularly fidelity and resolution measures. Algorithms for information extraction were assessed. A multifeature classification of a land scene and a Fourier analysis of a sea wave scene are recommended. ESA

N88-15116# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
STUDY OF SYNTHETIC APERTURE RADAR DATA COMPRESSION AND ENCODING. PART 2: SAR IMAGE SPECKLE SUPPRESSION AND DATA COMPRESSION ALGORITHMS Final Report
M. Langemann (Dornier-Werke G.m.b.H., Munich, West Germany) and W. C. Huisman Paris, France ESA 16 Sep. 1985

46 p
(Contract ESA-5829/84-NL-BI(SC))
(NLR-TR-85085-L-Pt-2; ESA-CR(P)-2448-Vol-2; ETN-88-91146)
Avail: NTIS HC A03/MF A01

Algorithms for reducing speckle in SAR images and the ensuing compression of these images are discussed. Speckle is suppressed by an adaptive local-variant two dimensional filter in the time domain, operating on blocks of 5 x 5 pixels. Compression is achieved by a transform coding algorithm. Monospectral treatment of SAR imagery is emphasized. Integration of the algorithms proves impossible. It is shown that data compression methods using an appropriate decorrelating transform on the optimally filtered channels are optimum for multispectral SAR-data compression. Compression methods exploiting clustered outcomes in multichannel imagery are suboptimal for compression of multispectral SAR data and have a lower performance than methods based upon transform coding, i.e., Chaturvedi algorithm. ESA

N88-15117*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ADDITIONAL STUDY AND IMPLEMENTATION OF TONE CALIBRATED TECHNIQUE OF MODULATION Final Report
W. Rafferty, L. K. Bechtel, and N. E. Lay Nov. 1985 141 p Prepared in cooperation with General Electric Co., Schenectady, N.Y.
(Contract JPL-957190)
(NASA-CR-182377; NAS 1.26:182377; JPL-9950-1214; Rept-125)
Avail: NTIS HC A07/MF A01 CSCL 17B

The Tone Calibrated Technique (TCT) was shown to be theoretically free from an error floor, and is only limited, in practice, by implementation constraints. The concept of the TCT transmission scheme along with a baseband implementation of a suitable demodulator is introduced. Two techniques for the generation of the TCT signal are considered: a Manchester source encoding scheme (MTCT) and a subcarrier based technique (STCT). The results are summarized for the TCT link computer simulation. The hardware implementation of the MTCT system is addressed and the digital signal processing design considerations involved in satisfying the modulator/demodulator requirements are outlined. The program findings are discussed and future direction are suggested based on conclusions made regarding the suitability of the TCT system for the transmission channel presently under consideration. B.G.

N88-15118# Massachusetts Inst. of Tech., Lexington.
ADAPTIVE DETECTION IN NON-STATIONARY INTERFERENCE, PART 3
Edward J. Kelly 24 Aug. 1987 99 p
(Contract F19628-85-C-0002)
(AD-A185622; TR-761-Pt-3; ESD-TR-86-090-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 17B

The analysis of Parts 1 and 2 of the report with this title has been extended into two directions. In the first case, the performance of an adaptive system with respect to signals arriving from directions other than the steering direction is evaluated. It is shown that these signals are reflected more strongly than would be suggested by the sidelobe levels of the adaptive patterns themselves. In the other case, the detection problem is generalized to include the detection of signals known only to lie in a subspace of the space of steering vectors. Again, performance is derived and the penalty associated with the greater uncertainty of the signal model is shown to be small. The analysis of Part 1 essentially repeated here, both to keep this report self-contained and to present an alternative version of the basic derivations. GRA

N88-15119# Michigan Univ., Ann Arbor.
CODING FOR SPREAD-SPECTRUM COMMUNICATIONS NETWORKS
Bal G. Kim Mar. 1987 159 p
(Contract N00014-85-K-0545)
(AD-A185667; Rept-022793-2-T; TR-244) Avail: NTIS HC A08/MF A01 CSCL 17B

The multiple-access capability of a frequency-hopp packet radio network is investigated from a coding point of view. The achievable region of code rate and channel traffic and the normalized throughput are considered as performance measures. We model the communication system from the modulator input to the demodulator output as an I-user interference channel, and evaluate the asymptotic performance of various coding schemes for channels with perfect side information, no side information, and imperfect side information. The coding schemes being considered are Reed-Solomon codes, concatenated codes, and parallel decoding schemes. We derive the optimal code rate and the optimal channel traffic at which the normalized throughput is maximized, and from these optimum values the asymptotic maximum normalized throughput is derived. The results are then compared with channel capacities. GRA

N88-15120# Naval Research Lab., Washington, D.C.
DEFORMATION EFFECTS ON MICROWAVE REFLECTIVITY Final Report, Oct. 1986 - Jul. 1987
J. A. Nemes and H. N. Jones 5 Oct. 1987 24 p
(AD-A185684; NRL-MR-6047) Avail: NTIS HC A03/MF A01 CSCL 20K

An investigtion has been made into the coupling between mechanical effects and electromagnetic response for dielectric materials. Measurements of reflectivity on panels which were subject to tensile stresses were made over a broad range of microwave frequencies. Results indicated that the change in reflectivity exceeded that expected from geometric changes alone. These results are discussed within the context of a coupled mechanical-electromagnetic theory. GRA

N88-15121# National Bureau of Standards, Gaithersburg, Md. Electrosystems Div.
SURVEY OF ELECTRONIC MEASUREMENT NEEDS BELOW 10 MHz
J. R. Sorrells Jun. 1987 92 p
(PB88-110366; NBSIR-87/3549) Avail: NTIS HC A05/MF A01 CSCL 20N

The results of a survey to assess the electronic measurement needs from dc to 10 MHz are presented. The questionnaire used in the survey covered three broad areas of measurement need: (1) basic electrical quantities and related precision instruments; (2) automatic test equipment and other complex measurement systems; and (3) conducted electromagnetic interference. The data provided by 527 respondents are summarized, and the results of various analyses are described. Several conclusions, suggested by the analyses, are also discussed. GRA

N88-15122# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
HORN DESIGN EQUATIONS FOR THE NBS (NATIONAL BUREAU OF STANDARDS) HORN-TYPE NOISE STANDARDS
W. C. Daywitt Aug. 1987 18 p Sponsored by Department of the Air Force, Washington, D.C. and Naval Ocean Systems Center, San Diego, Calif.
(PB88-110226; NBSIR-87/3073) Avail: NTIS HC A03/MF A01 CSCL 20N

Equations are given for calculating the interior dimensions of the horn pickup in the NBS millimeter wave noise standards. These dimensions insure negligible internal horn reflections, resulting in an accurate calculation of the horn attenuation. Measurements in the WR10 horn show a reflection of magnitude less than 0.001. GRA

N88-15123# Foersvarets Forskingsansalt, Stockholm (Sweden).
INVERSE SCATTERING ANALYSIS OF DIFFRACTION LIMITED SAR
H. Hellsten Jul. 1987 22 p
(PB88-105580; FOA-C-30459-3.2) Avail: NTIS HC A03/MF A01 CSCL 20N

The inverse problem of reconstructing the ground topography on the basis of SAR data is set up and solved analytically. The solution incorporates compensation for antenna effects (an

interferometric antenna configuration is understood, since a single antenna will not be capable of illuminating the ground on just one side of the aircraft over the frequency band intended. The inversion process lead to a 2-dimensional Poisson equation for the ground surface angular height function, the source density of the equation corresponding to the conventional SAR ground reflectivity. Because the shape of the ground is described relative to the aircraft, there will be a certain latitude in this description, relating to aircraft motions, which will not affect radar data. The boundary conditions of the equation are invoked accordingly. GRA

N88-15124# Woods Hole Oceanographic Institution, Mass.
MULTIPATH TIME-DELAY ESTIMATION VIA THE EM ALGORITHM
M. Feder and E. Weinstein Jan. 1987 33 p
(Contract N00014-80-C-0381)
(PB88-106851; WHOI-87-3) Avail: NTIS HC A03/MF A01 CSCL 20N

Sounds radiated from an acoustic point source in the ocean arrive at the receiver over more than one path. Given prior knowledge of the geophysical parameters characterizing the channel between source and receiver, the observed multipath delay information can be used to estimate the location (i.e., range and depth) of the source relative to the receiver. The application of the EM algorithm to the multipath time delay estimation is considered. The algorithm is developed for the case of deterministic (known) signals, as well as for the case of wide-sense stationary Gaussian signals. GRA

N88-15125# Institute of Gas Technology, Chicago, Ill.
ADVANCED COMMUNICATION SYSTEMS: A REPORT ON FIBER OPTIC TECHNOLOGY AND ITS POSSIBLE APPLICATIONS IN THE GAS INDUSTRY Final Report, 1 Jul. 1986 - 28 Feb. 1987
C. J. Ziolkowski, W. F. Rush, and N. C. Saha Aug. 1987 89 p
(Contract GRI-5086-271-1299)
(PB88-112792; GRI-87/0131) Avail: NTIS HC A05/MF A01 CSCL 17B

The applicability of fiber optic technology to the area of natural gas distribution is examined. The basic technology of fiber optics is outlined. Some of the commercially available products are examined. The two areas where fiber optics might be successfully applied to gas distribution needs are the remote control of district pressure regulators and the lease of communication capability to interested parties. Author

N88-15126# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
WAVEFORM FOR SHORT-DWELL-TIME METEOROLOGICAL DOPPLER RADARS
R. G. Strauch Jun. 1987 28 p
(PB88-102199; NOAA-TM-ERL-WPL-146) Avail: NTIS HC A03/MF A01 CSCL 20N

A modulation waveform for meteorological Doppler radars that obtain estimates of radar reflectivity, mean velocity, and Doppler width with very short dwell time is described. The transmitted signal is a sequence of three identical chirp pulses; signal parameters can be estimated from the radar echoes of a single sequence with standard deviation similar to that of conventional meteorological radars that use dwell time more than an order of magnitude longer. GRA

N88-15127# Sandia National Labs., Albuquerque, N. Mex.
MICROSECOND BEAM PROPAGATION IN AIR
E. T. Powell, G. W. Kamin, J. S. Wagner, and R. J. Lipinski 1987 3 p Presented at the SDIO/DARPA Services Annual Propagation Review, Monterey, Calif., 29 Sep. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002221; SAND-87-2534C; CONF-8709146-20) Avail: NTIS HC A02/MF A01

A 3-MeV, 2-kA, 2 microsec unconditioned electron beam has been propagated a distance of 1.2 meters in air at the EPOCH facility at Sandia National Laboratories-Albuquerque. Time-integrated photographs show stable propagation throughout the entire distance the beam was visible (approx. 2 L(sub N) or approx. 5 lambda sub Beta). Additional experiments were performed in an evacuated, 14-meter long tank at pressures between 15 mT and 100 T. In these cases no stable propagation was observed above 50 mT. Below mT the beam was marginally stable. The OOSIK simulation code was run for the open air case with reasonable agreement. DOE

N88-15128*# Ohio State Univ., Columbus. ElectroScience Lab.
BACKSCATTER FROM A PERIODIC ROUGH SURFACE AT NEAR GRAZING INCIDENCE
A. K. Dominek and H. T. Shamansky Oct. 1987 27 p
(Grant NsG-1613)
(NASA-CR-182397; NAS 1.26:182397; ELS-TR-716148-24)
Avail: NTIS HC A03/MF A01 CSCL 20N

The effect of periodic surface roughness on the radar cross section (RCS) was studied. The surface roughness was formed by a small sinusoidal variation in a planar surface. RCS measurements were obtained for two different sinusoidal variations near grazing incidence for both principle polarizations. Significant grating lobes were observed in the measurements which directly correspond to the roughness characteristics. A physical optics solution was generated and compared to the measurements with reasonable agreement. Author

N88-15129# Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
MODEM FOR DIGITAL PHASE MODULATION: RESULTS AND SUMMARY
O. Trandem Jun. 1986 30 p Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-149233; STF44-A86051; ISBN-82-595-4264-1) Avail: NTIS HC E04/MF E04 CSCL 20N

A model for Digitally Phase Modulated signals was implemented by means of TMS 32010 general signal processors. Measured performance and design solutions are reported. Reducing the transmitted spectrum width slightly beyond that of the main lobe of binary PSK, improved noise and interference immunity is achieved. An error rate of 0.01 is sustained for E(b)/N(o)= 3.5 dB or C/I =2 dB carrier to cochannel interference signal ratio. Author

N88-15130*# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC FIELDS BACKSCATTERED FROM AN S-SHAPED INLET CAVITY WITH AN ABSORBER COATING ON ITS INNER WALLS Final Report
R. J. Burkholder, C. W. Chuang, and P. H. Pathak 30 Jul. 1987 127 p
(Grant NAG3-476)
(NASA-CR-182401; NAS 1.26:182401; FR-715723-2) Avail: NTIS HC A07/MF A01 CSCL 20N

The EM backscatter from a two-dimensional S-shaped inlet cavity is analyzed using three different techniques, namely a hybrid combination of asymptotic high frequency and modal methods, an integral equation method, and the geometrical optics ray method, respectively. This inlet has a thin absorber coating on its perfectly conducting inner walls and the planar interior termination is made perfectly conducting. The effect of the absorber on the inner wall is treated via a perturbation scheme in the hybrid approach where it is assumed that the loss is sufficiently small for the method to be valid. The results are compared with the backscatter from a straight inlet cavity to evaluate the effect of offsetting the termination in the S-bend configuration such that it is not visible from the open end of the inlet. The envelope of the backscatter pattern for the straight inlet is always seen to peak around the forward axis due to the large return from the directly visible termination, and the pattern envelope tapers off away from the forward axis. Offsetting the termination causes the envelope of the backscatter pattern to flatten out, thereby reducing the return near the forward axis by several dB. The absorber coating reduces the pattern level of the straight inlet in directions away from the

forward axis but has little effect on the peak near the axis; furthermore, the absorber coating is seen to consistently reduce the backscatter from the S-bend inlet for almost all incidence angles. The hybrid method gives excellent agreement with experimental data and with the integral equation solution, whereas, the geometrical optics ray tracing method is able to generally predict the average of the bachscatter pattern but not the pattern details. Author

N88-15131# Oak Ridge National Lab., Tenn.
SHIELDING EFFECTIVENESS AGAINST ELECTROMAGNETIC INTERFERENCE
J. M. Googe and R. A. Hess Oct. 1987 16 p
(Contract DE-AC05-84OR-21400)
(DE88-003664; ORNL/TM-10512) Avail: NTIS HC A03/MF A01

The use of metal-filled and metal-coated plastics and other modified dielectric materials to replace metals for enclosures has created a need to test these materials for their electromagnetic interference (EMI) shielding effectiveness (SE). Shielding effectiveness involves a variety of electromagnetic environments, and useful data can be obtained from tests that carefully limit the environment to that of a plane wave. Such an environment can be created in a circular or rectangular transmission line. Two such transmission line test fixtures, which hold samples of the material to be tested, have been developed. The fixtures described in this report are the National Bureau of Standards (NBS) coaxial transverse electromagnetic (TEM) cell, and a dual TEM cell constructed at ORNL from a design suggested by the NBS. The NBS coaxial fixture is an improved version of the device recommended by the American Society for Testing and Materials (ASTM). The problems associated with measuring SE are well described in the literature. The two methods described here are the result of years of work to establish procedures and instrumentation that will produce acceptable data. DOE

N88-15132# Centro Tecnico Aerospacial, San Jose dos Campos (Brazil). Inst. de Estudos Avancados.
INTERACTION OF INTENSE ELECTROMAGNETIC FIELDS WITH SF/SUB 6/ MOLECULES AND CLUSTERS IN SUPERSONIC EXPANSION
V. J. T. Airoldi Jan. 1987 169 p In PORTUGUESE; ENGLISH summary
(DE88-700310; CTA-IEAV-RP-02/87) Avail: NTIS (US Sales Only) HC A08/MF A01

A method of measuring SF/sub 6/ cluster formation and inhibition in pulsed supersonic expansion in the presence of intense electromagnetic radiation is presented. The characterization of the expansion of SF/sub 6/ molecules was done and, the extension of the collision region was determined. An improved unidimensional theory of supersonic expansion showed good agreement with the experimental results. The spectra of multiphoton absorption of SF/sub 6/ molecules in supersonic jet and the average energy absorved by each molecule were determined. The absorption spectra of molecule in the collision region present absorption maxima different from those obtained in the collisionless region. The results, if compared with the literature data, show good agreement, with a small difference in the spetra corresponding to the collisionless region. This difference was observed, for the first time in the multiphoton absorption and is attribuited to cluster formation in the jet. A new technique for measuring cluster formation in the supersonic jet, based on determination of the spatial distribution of the energy of molecules in the jet after passing through a skimmer located in the collision region is shown. The inhibition of cluster formation, due to the incidence of intense electromagnetic radiation from a CO/sub 2/-TEA pulsed laser in the initial collision region of the jet, causes a second expansion in the skimmer. The results obtained show that this method can lead to a new isotope separation process. All the parts of the experimental set up, for example, high vacuum system, pulsed valve and pyroelectric detector, were developed and constructed specially for the experiment. DOE

N88-15133# Academy of Sciences of the Armenian SSR, Erivan.
MATERIALS FOR ACCELERATION BY SURFACE ELECTROMAGNETIC WAVES
S. G. Arutyunyan and N. G. Ter-Arutyunyan-Savvidi 1986 28 p In RUSSIAN; ENGLISH summary
(DE88-700312; EFI-874-25-86) Avail: NTIS (US Sales Only) HC A03/MF A01

Recommendation to the choice of materials for accelerating dielectric resonator are elaborated on the basis of a great number of studied literature on optical resistance. A catalog of properties of material perspective for the use in this purpose is made up (CsI, Ge, LiF, SrTiO/sub 3/ and etc, in particular). DOE

N88-15134# Academy of Sciences of the Armenian SSR, Erivan.
OPTIMIZATION OF CHARGED PARTICLE ACCELERATION RATE OVER WAVE PARAMETERS IN THE SCHEME WITH ACCELERATION BY SURFACE ELECTROMAGNETIC WAVES
N. G. Ter-Arutyunyan-Savvidi 1986 10 p In RUSSIAN; ENGLISH summary
(DE88-700320; EFI-904-55-86) Avail: NTIS (US Sales Only) HC A02/MF A01

The rate of acceleration of charged particles accelerated by surface electromagnetic wave is optimized over the index of refraction of material and the angle of incidence of the wave at optimal polarization. In case of non-optimal polarization, the acceleration rate is optimized over the angle of incidence for KRS - 5 glass. DOE

N88-15135# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
PLANE LONGITUDINAL WAVES IN SOLUTIONS OF MAXWELL EQUATIONS
G. A. Kotelnikov 1986 8 p In RUSSIAN
(DE88-700347; IAE-4317/1) Avail: NTIS (US Sales Only) HC A02/MF A01

It is shown that Maxwell equations admit solutions in the form of longitudinally polarized plane electromagnetic waves. Transformation properties of the fields in the frames of Galilei and relativistic symmetries are determined. Invariants of the fields transformation are plotted. DOE

N88-15136# Lawrence Livermore National Lab., Calif.
TREATMENT OF SMALL WIRE LOOPS IN THE METHOD OF MOMENTS CODE NEC (NUMERICAL ELECTROMAGNETICS CODE)
G. J. Burke Oct. 1987 22 p
(Contract W-7405-eng-48)
(DE88-002995; UCID-21196) Avail: NTIS HC A03/MF A01

The Numerical Electromagnetics code (NEC) is generally an accurate and versatile method-of-moments code for modeling wire antennas. NEC has been found to suffer loss of accuracy in VLF applications involving electrically small antennas, however. Some of these problems were discussed previously and corrections demonstrated to improve accuracy for open wire antennas such as dipoles. This report covers the special problems of modeling small wire loops. To model small loops the method-of-moments solution now used in NEC, with point matching and spline basis functions, was modified to use a constant loop basis function and a loop weighting function on each loop. The need for loop basis and weighting functions on small loops has been noted previously for a Galerkin method-of-moments code similar to MININEC. This treatment is implemented in the NEC solution with an approximation of the loop weighting. Also, an algorithm was developed for finding and labeling loops on which the new basis and weighting functions should be applied. The option for loop basis and weighting functions has been incorporated into the code NEC3 VLF which resulted from the previous VLF enhancement described. The improvement in solution accuracy and stability is demonstrated for loop antennas, loops coupled to dipoles and wire grids. DOE

N88-15137# Lawrence Livermore National Lab., Calif.
TRACKER: A 3-D RADIO RAY TRACING CODE
R. E. Carlson and J. H. Ellison Oct. 1987 24 p
(Contract W-7405-eng-48)
(DE88-003267; UCID-21204) Avail: NTIS HC A03/MF A01

TRACKER is a 3-D radio ray tracing code which has been designed to simulate high frequency radio wave propagation through a perturbed ionosphere. It is the centerpiece of a family of codes written for the Cray-1 computer whose purpose is to model radar systems for use in detecting and identifying ionospheric perturbations. TRACKER accepts as input a perturbation file that describes the shape of an acoustic pulse at a discrete set of points in space at various times since the pulse was initiated. Except for a sophisticated set of interpolation algorithms needed to approximate the pulse shape at an arbitrary point, the perturbation model is external to TRACKER. The features that distinguish TRACKER from other ray tracing codes are the physics models, the state-of-the-art computational algorithms, the structure and modularity of the code itself, the interactive operational mode, and the sophisticated graphical output. DOE

N88-15138# Selenia S.p.A., Rome (Italy).
STUDY OF A RADIO REALY LINK (RRL). CASSINI MISSION. DATA PACKAGE FOR FINAL PRESENTATION Final Report
Boukamp, Heimerdinger (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany), G. Losquardo, G. Farricella, and M. Sarno Paris, France ESA 8 Oct. 1987 416 p
(Contract ESTEC-6576/85-NL-PB)
(ESA-CR(P)-2472; ETN-88-91157) Avail: NTIS HC A18/MF A01

A radio relay link for the Cassini mission, featuring high accuracy Doppler measurements, very fast RF carriers and angular acquisition, wide range of tracking angle for orbiter antenna, large selection capability of different bit rates and/or format, and acceptable ultra stable oscillator source to provide accurate and repetitive Doppler shift measurements is proposed. System analyses; design configuration; system and equipment tradeoffs; budgets; accuracy of system performance; equipment specifications and I/F definition; analog and digital design; antenna(s); and technology constraints are discussed. ESA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N88-15139# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
SURFACE CHEMISTRY OF CHEMICALLY SENSITIVE FIELD EFFECT TRANSISTORS Final Report, 17 Apr. 1984 - 30 Nov. 1986
Mark S. Wrighton 22 Sep. 1987 8 p
(Contract N00014-84-K-0291)
(AD-A185917) Avail: NTIS HC A02/MF A01 CSCL 09A

This report highlights the research accomplishments in connection with studies of microelectrochemical devices including transistors and diodes. A bibiliography of published work in connection with the contract is included. GRA

N88-15140# Menteck, Inc., College Station, Tex.
AN INVESTIGATION OF THE RECHARGABILITY OF CERTAIN MODIFIED FORMS OF MnO2 Quarterly Report No. 1
A. J. Appleby 30 Sep. 1987 4 p
(Contract N00014-87-C-0662)
(AD-A185919; AD-F000114) Avail: NTIS HC A02/MF A01 CSCL 10C

The objective of the present contract is to develop a high rate rechargeable zinc manganese dioxide system based on Ford's technology and to examine the possibility of a rechargeable lithium organic electrolyte intercalation type system using birnessite manganese dioxide(MnO2) compounds. In addition, some studies on the structures of compounds will be carried out, as may be possible according to the technical means available, on the scientific reasons for the rechargeability of birnessite. Examples of scientific techniques that may throw light on this were quoted in the statement of work as Fourier Transform Infra Red Spectroscopy (FTIR), X ray diffraction and EXAFS. GRA

N88-15141# Naval Postgraduate School, Monterey, Calif.
USER MANUAL FOR ATILA, A FINITE-ELEMENT CODE FOR MODELING PIEZOELECTRIC TRANSDUCERS Interim Report, Jul. - Aug. 1987
Jean-Noel Decarpigny and Jean-Claude Debus Sep. 1987 131 p
(AD-A185948; AD-F000114; NPS-61-87-007) Avail: NTIS HC A07/MF A01 CSCL 17A

This manual for the user of the finite-element code ATILA provides instruction for entering information and running the code on a VAX computer. The manual does not include the code. The finite element code ATILA has been specifically developed to aid the design of piezoelectric devices, mainly for sonar applications. Thus, it is able to perform the model analyses of both axisymmetrical and fully three-dimensional piezoelectric transducers. It can also provide their harmonic response under radiating conditions: nearfield and farfield pressure, transmitting voltage response, directivity pattern, electrical impedance, as well as displacement field, nodal plane positions, stress field and various stress criteria...Its accuracy and its ability to describe the physical behavior of various transducers (Tonpilz transducers, double headmass symmetrical length expanders, free flooded rings, flextensional transducers, bender bars, cylindrical and trilaminar hydrophones...) have been checked by modelling more than twenty different structures and comparing numerical and experimental results. GRA

N88-15142# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
THE dc CONDUCTIVITY STUDIES OF AN HYDROXIDE ION CONDUCTOR AT INTERMEDIATE TEMPERATURES
S. Crouch-Baker and R. A. Huggins 30 Jul. 1987 4 p
(Contract N00014-84-K-0648)
(AD-A186044; TR-7) Avail: NTIS HC A02/MF A01 CSCL 07D

Preliminary experiments are conducted on an hydroxide ion-conducting electrolyte, which may have potential for application to the electrolysis of steam at intermediate temperatures. In this work the dc conductivity of wet Li5AlO4 samples has been measured as a function of temperatures and applied voltage. It is proposed that, under the conditions employed here, dc charge conduction is due to the transport of hydroxide ions derived from the LiOH contained in the structure, rather than by electronic species. GRA

N88-15143# Rome Univ. (Italy). Dipt. di Fisica.
ELECTRONICS FOR THE EXTERNAL MUON DETECTOR (EMD) OF ICARUS
F. Massa (Istituto Nazionale di Fisica Nucleare, Rome, Italy) 23 Apr. 1987 52 p
(Nota-Interna-880; ICARUS-87/25; ETN-88-91241) Avail: NTIS HC A04/MF A01

Solutions for the selective electronic trigger-system and for the time-of-flight measurements which involve quite different scales for rare high energy muons traveling upwards through ICARUS; and possible heavy monopoles traversing ICARUS with velocity Beta greater than 0.0001 are considered. The applicability of the external muon detector (EMD) to the relevant physics goal of monopole detection is discussed. Two solutions for the EMD time measurements are satisfactory, provided that the single layer proportional counter background rate is less than 2kHz/sqm, as it is at present. ESA

N88-15144# Naval Research Lab., Washington, D.C.
SUPERCONDUCTING SWITCH PROGRAM Interim Report, Sep. 1985 - Sep. 1986
T. L. Francavilla, S. A. Wolf, and D. U. Gubser 30 Sep. 1987 19 p
(AD-A185682; NRL-MR-5997) Avail: NTIS HC A03/MF A01 CSCL 09A

The NRL Superconducting Opening switch program for 1985 to 1986 is reviewed. The results of material studies to determine sputtering parameters is presented along with preliminary switching studies to determine switching speed. The investigation is continuing. GRA

N88-15145# Naval Research Lab., Washington, D.C.
MODULATION OF AN INTENSE BEAM BY AN EXTERNAL MICROWAVE SOURCE: THEORY AND SIMULATION Interim Report
J. Krall (Science Applications International Corp., McLean, Va.) and Y. Y. Lau 7 Oct. 1987 17 p
(Contract DE-AI05-86ER-13585)
(AD-A185683; NRL-MR-6083) Avail: NTIS HC A03/MF A01 CSCL 20H

A time dependent, fully electromagnetic particle code is used to simulate the current modulation in an intense relativistic electron beam (IREB) by an external RF source. It is shown that the intense beam may serve as a power amplifier with good phase stability, as suggested in earlier experiments. Increase in beam bunching by the dc space charge is demonstrated with a simple analytical model. GRA

N88-15146*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A SMALL, GRAPHITE ELECTRODE, MULTISTAGE DEPRESSED COLLECTOR WITH A 500-W, CONTINUOUS WAVE, 4.8- TO 9.6-GHz TRAVELING WAVE TUBE
Peter Ramins, Gary G. Lesny, Ben T. Ebihara, and Shelly Peet Feb. 1988 15 p
(NASA-TP-2788; E-3800; NAS 1.60:2788) Avail: NTIS HC A03/MF A01 CSCL 09A

A small, isotropic graphite multistage depressed collector (MDC) and a short permanent magnet refocuser were designed, fabricated, and evaluated in conjunction with a 500-W, continuous-wave (CW), 4.8 to 9.6 GHz traveling wave tube (TWT). A novel performance optimization system and technique were used to optimize the TWT-MDC performance for saturated broad-band operation. The MDC performance was evaluated in both four- and three-stage configurations. Average TWT overall and four-stage collector efficiencies of 43.8 and 82.6 percent, respectively, were obtained for saturated octave-bandwidth operation. The isotropic graphite electrode material performed well, and shows considerable promise. However, considerably more test experience is required before definitive conclusions on its suitability for space and airborne TWT's can be made. Author

N88-15147# Sandia National Labs., Albuquerque, N. Mex.
RADIATION HARDNESS EVALUATION OF THIN FILM FERROELECTRIC CAPACITORS
T. F. Wrobel, J. A. Bullington, and L. J. Schwee (Naval Surface Weapons Center, Silver Spring, Md.) 1987 5 p Presented at the Challenges Facing Government Electronics in the 1990's, Orlando, Fla., 27 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE88-001357; SAND-87-2501C; CONF-871032-1) Avail: NTIS HC A02/MF A01

Ferroelectric capacitor structures have been evaluated in total dose, dose-rate and cosmic ray environments. The capacitors were found to maintain polarization following an exposure of approx. 5 Mrad (Si), approx. 1 x 10 to the 11th power rad(Si)/s and approx. 6 x 10 to the 6th power Cf-252 fission fragments per sq cm. The capacitors show minimal degradation in the P versus E hysteresis curve following approx. 10 Mrad(Si), approx. 1 x 10 to the 11th power rad(Si)/s and approx. 6 x 10 to the 6th power Cf-252 fission fragments per sq cm. In addition, no heavy ion induced hard errors were observed for capacitor bias levels below the intrinsic breakdown voltage of 20 V. DOE

N88-15612*# Tennessee Univ., Martin. School of Engineering Technology and Engineering.
EVALUATION OF HIGH-VOLTAGE, HIGH-POWER, SOLID-STATE REMOTE POWER CONTROLLERS FOR AMPS
Charles P. Callis *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 24 p (For primary document see Summer Faculty Fellowship Program 24 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N88-15148*# Old Dominion Univ., Norfolk, Va.
SECONDARY SUBHARMONIC INSTABILITY OF BOUNDARY LAYERS WITH PRESSURE GRADIENT AND SUCTION
Nabil M. El-Hady Washington NASA Feb. 1988 44 p
(Grant NAG1-729)
(NASA-CR-4112; NAS 1.26:4112) Avail: NTIS HC A03/MF A01 CSCL 20D

Three-dimensional linear secondary instability is investigated for boundary layers with pressure gradient and suction in the presence of a finite amplitude TS wave. The focus is on principal parametric resonance responsible for a strong growth of subharmonics in a low disturbance environment. Calculations are presented for the effect of pressure gradients and suction on controlling the onset and amplification of the secondary instability. Author

N88-15149# Naval Research Lab., Washington, D.C.
FOAM GENERATION AND AIR ENTRAINMENT NEAR A FREE SURFACE Memorandum Report, Oct. 1985 - Apr. 1987
D. W. Hubbard, O. M. Griffin, and R. D. Peltzer 30 Sep. 1987 37 p
(AD-A185986; NRL-MR-6038) Avail: NTIS HC A03/MF A01 CSCL 20D

The flow in a breaking wave is a type of agitation which is conducive to foam formation. The downstream wake of a surface vessel in the seaway also is characterized by a layer of foamy, agitated water near the surface, and a subsurface layer bubbles or a bubble cloud. The purpose of this report is to discuss the basic features of foam and bubble formation, and air entrainment as these features are known at the present time. We shall discuss possible means for relating these basic features to the processes of deep water wave breaking and of wake formation and development for surface ships moving in the seaway. GRA

N88-15150# Naval Research Lab., Washington, D.C.
HIGH RESOLUTION SIMULATION OF TURBULENT FLOW IN A CHANNEL Interim Report, Mar. 1986 - Mar. 1987
Robert A. Handler, R. I. Leighton, and D. M. Carroll 25 Sep. 1987 31 p
(AD-A186022; NRL-MR-6009) Avail: NTIS HC A03/MF A01 CSCL 20D

A simulation of turbulence in a channel is performed using 128 x 64 x 65 grid points. No turbulence models are incorporated in the calculation. After an initial lower resolution run, the flow is driven by a constant force. At the end of the run, which lasts 54.4 time units, the flow achieves a dynamic equilibrium in the sense that the wall shear stress is balanced almost exactly by the driving force. The global properties of the flow are discussed

in detail and some initial results of coherent structures using conditional sampling are presented. GRA

N88-15151# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE NUMERICAL AND ANALYTICAL STUDY OF BIFURCATION AND MULTICELLULAR FLOW INSTABILITY DUE TO NATURAL CONVECTION BETWEEN NARROW HORIZONTAL ISOTHERMAL CYLINDRICAL ANNULI AT HIGH RAYLEIGH NUMBERS M.S. Thesis
Daniel B. Fant 1987 251 p
(AD-A186113; AFIT/CI/NR-87-134D) Avail: NTIS HC A12/MF A01 CSCL 20M

This effort deals with a numerical and analytical study of multicellular flow instability due to natural convection between narrow horizontal isothermal cylindrical annuli. Buoyancy-induced steady or unsteady flow fields between the annuli are determined using the Boussinesq approximated two-dimensional Navier-Stokes equations and the viscous-dissipation neglected thermal-energy equation. The vorticity stream function formulation of the Navier Stokes equations is adopted. Both thermal and hydrodynamic instabilities are explored. An asymptotic expansion theory is applied to the Navier-Stokes equations in the double-limit of Rayleigh number approaching infinity and gap width approaching zero. Thermal instability of air near the top portions of narrow annuli is considered for various size small gap widths. For these narrow gaps, the Rayleigh numbers corresponding to the onset of steady multicellular flow are predicted. Numerical solutions of the 2-D Navier Stokes equations also yield hysteresis behavior for the two-to-six and two-to-four cellular states, with respect to diameter ratios of 1.100 and 1.200. In contrast, an unsteady hydrodynamic multicellular instability is experienced near the vertical sections of narrow annuli when the Pr approaches 0 boundary layer equations are solved numerically. GRA

N88-15152# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ON THE PARABOLIZED NAVIER-STOKES EQUATIONS WITHOUT SUBLAYER ASSUMPTIONS M.S. Thesis
Stephen C. Pluntze Jan. 1987 151 p
(AD-A186127; AFIT/CI/NR-87-84T) Avail: NTIS HC A08/MF A01 CSCL 20D

A new implicit, iteractive method of solving the Parabolized Navier-Stokes (PNS) Equations claims to overcome the elliptic character of the embedded subsonic sublayer by explicitly introducing pressure as an additional state variable. The Bhutta-Lewis approach makes no sublayer pressure assumptions. The validity and basis of that method is explored in this thesis by examining the relevant eigenvalues governing marching stability. An original code was also developed in order to examine the numerical character of the marching, iterative solutions as they develop. Test cases were carried out for a two dimensional wedge configuration at Mach numbers 3 and 15 and Reynolds numbers ranging from 4000 to 10 million at the initial data plane. An eigenvalue analysis disclosed that the method is unstable in subsonic regions. Results for the test cases confirmed the presence of instability. Classic departure behavior was produced in tightly clustered grids and convergence to separated flow was shown in less clustered grids. Marching was achieved only in relatively high Reynolds number flow with a large stable marching step size. GRA

N88-15153# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
CHEMICAL REACTIONS IN TURBULENT MIXING FLOWS Annual Report, Apr. 1986 - Apr. 1987
P. E. Dimotakis, J. E. Broadwell, and A. Leonard 1 Jun. 1987 23 p
(Grant AF-AFOSR-0213-83)
(AD-A186141; AFOSR-87-1160TR) Avail: NTIS HC A03/MF A01 CSCL 20D

Work continues primarily in gas phase turbulent mixing amd chemical reactions with extensions to compressible (supersonic) shear layers. In the gas phase shear layer work, investigations concentrate on subsonic shear layer free stream density ratio effects, and a design effort in support of the planned extension of the hydrogen-fluorine shear flow facility to supersonic flows. In jet flows, measurements of gas phase jet mixing, using laser Rayleigh scattering techniques developed for conserved scalar measurements down to diffusion space and time scales, are in progress. A first publication has just appeared on an experiment in which digital imaging of soot in turbulent flames was used to describe combustion flame sheets in methane flames. Analytical/computational modeling efforts included development of quantitative description of turbulent jet mixing and chemical reactions including finite Damkoehler number effects; supersonic shear layer combustion studies of finite kinetic rate (Damkoehler number) effects for H2/F2/NO and H2/air systems; a new analytical model for turbulent shear layer mixing and chemical reactions; and extensions of hydrodynamic stability calculations to include Mach number effects in supersonic shear layers. GRA

N88-15154# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
EFFECTS OF TURBULENCE ON STATIONARY AND NON-STATIONARY PROCESSES IN C-SYSTEMS Final Technical Report, 1 Sep. 1985 - 30 Nov. 1986
Ted A. Roberts and Robert A. Beddini 1 Jun. 1987 36 p
(Grant AF-AFOSR-0348-85)
(AD-A186215; AAE-87-1; UILU-ENG-87-0501; AFOSR-87-0980TR) Avail: NTIS HC A03/MF A01 CSCL 21B

Turbularization of an acoustic boundary layer (Stokes Layer) on impermeable and permeable surfaces is analytically considered. The theoretical approach uses a second-order closure model of turbulence. Both an approximate, closed-form solution and a more comprehensive finite difference solution of the time dependent, parabolic, one-dimensional governing equations are obtained. For simple acoustic boundary-layers on impermeable surfaces, both the approximate solution and the numerical results for the critical acoustic Mach number required for turbulent transition are qualitatively confirmed by experiment. Calculations for acoustic boundary-layers with transpiration (injection) indicate a substantial reduction of the acoustic Mach number required for transition, up to a limiting injection velocity that is frequency dependent. The results may provide a mechanism for flow-related combustion instability in practical systems, particularly solid propellent rockets, since turbularization of the near-surface combustion zone could result at relatively low acoustic Mach numbers. This report documents a completed phase of work which is concerned with the analysis of turbulent flow and heat transfer behavior in rocket chamber flows (C-systems). GRA

N88-15155# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Engineering Mechanics.
ANALYSIS OF THREE-DIMENSIONAL VISCOUS INTERNAL FLOWS Final Report, Jul. 1985 - Sep. 1986
Kirti N. Ghia and Urmila Ghia 31 Mar. 1987 47 p
(Grant AF-AFOSR-0231-85)
(AD-A186254; UC-ASE-87-6-71; AFOSR-87-1215TR) Avail: NTIS HC A03/MF A01 CSCL 20D

A fifteen-month multi-tasked research project was pursued by the present investigators to study complex viscous flows under AFOSR sponsorship between July 1985 and September 1986. The major objective of this study was to require improved understanding of viscous flows and to develop basic computational methods for efficient determination of 2-D/3-D subsonic and incompressible flows. Two major analyses were pursued. These include the Interacting Parabolized Navier-Stokes (IPNS) analysis for steady flows and the full Navier-Stokes (NS) analysis for direct simulation of unsteady flows. The IPNS analysis developed employs no ad hoc artificial dissipation and, in spite of being a density-based formulation, performs well even for very low Mach numbers. The applications considered include 2-D cascades and channels of simple geometry. GRA

N88-15156# Universities Space Research Association, Columbia, Md.
SPECTRAL METHODS: ANALYSIS AND APPLICATIONS TO FLOW PROBLEMS Final Scientific Report
David Gottlieb 22 Dec. 1986 8 p
(Grant AF-AFOSR-0089-83)
(AD-A186265; AFOSR-87-1223TR) Avail: NTIS HC A02/MF A01 CSCL 20D

It is shown that methods for the solution of incompressible flow problems can be characterized as belonging to either parabolic or elliptic type with regard to the determination of pressure field. The elliptic schemes typically have smaller errors in the divergence field, with the errors decaying exponentially away from the boundaries of the computational domain. On the other hand, the parabolic schemes have smooth solutions, without numerical boundary layers, but care should be exercised with respect to the boundary conditions in order that initial divergence errors be eliminated. This analysis explains why elliptic schemes, like that introduced by Harlow Welch (1965) have been found to be more accurate than parabolic schemes. GRA

N88-15157# Tel-Aviv Univ. (Israel). School of Engineering.
ON THE PAIRING PROCESS IN AN EXCITED, PLANE, TURBULENT MIXING LAYER Final Technical Report, 15 Aug. 1985 - 15 Aug. 1986
I. Wygnanski and I. Weisbrot Aug. 1987 16 p
(Grant AF-AFOSR-0333-84)
(AD-A186355; AFOSR-87-1165TR) Avail: NTIS HC A03/MF A01 CSCL 20D

The flowfield of a plane, turbulent mixing layer disturbed by a small oscillating flap was investigated. Three experiments were carried out: one in which the flap oscillated sinusoidally at a single frequency, a second in which the flap oscillation at two frequencies, a fundamental and a subharmonic; and a third in which the amplitude of the subharmonic perturbation was increased until a distortion in the mean flow was detected. Two velocity components were measured at all phase angels intervals. The data were used to map vorticity fields and the streak-line patterns for the purpose of assessing the relevance of the latter to the understanding of the dynamical processes involved. GRA

N88-15158# Naval Ship Research and Development Center, Bethesda, Md.
NUMERICAL CALCULATION OF APPENDAGE, FLAT PLATE JUNCTION FLOW Final Report
Roger W. Burke Sep. 1987 37 p
(AD-A186371; DTNSRDC-87/002) Avail: NTIS HC A03/MF A01 CSCL 20D

A steady, incompressible, three-dimensional Reynolds equation solver was applied to the problem of flow past an appendage mounted on a flat plate. The code, called INS3D, was developed in a joint effort between NASA Ames Research Center and Rocketdyne, INS3d handles the pressure using a pseudo-compressibility approach to obtain a steady-state solution. A beam-warming approximate factorization scheme is used to discretize the equations. A Baldwin-Lomax type scheme was used to parameterize the shear stresses for the appendage-flat plate problem. Comparisons were made with wind tunnel experiments of Dickinson, conducted in the low turbulence wind tunnel at DTNSRDC. The observed and predicted pressure distributions on the flat plate agreed well, but the lateral extent of the horseshoe vortex was overpredicted compared to experimental data. Predicted mean and cross flow velocities exhibited all the essential features of the appendage-flat plate corner region, and showed good qualitative agreement with the experiments. GRA

N88-15159# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mechanical and Aerospace Engineering.
NONLINEAR AND NONPARALLEL STABILITY PROBLEMS Final Report, Jul. 1984 - Nov. 1986
E. Reshotko Jun. 1987 7 p
(Grant AF-AFOSR-0148-84)
(AD-A186406; AFOSR-87-1276TR) Avail: NTIS HC A02/MF A01 CSCL 20D

An analysis was developed describing the spatial parallel flow development of disturbances that are introduced into an incompressible laminar boundary layer by a vibrating ribbon at the wall. The dominant mode is corresponding to the eigenmode of the flow at the ribbon frequency, as found by Gaster, but the solution technique does not require the questionable assumptions previously invoked. Analysis of the compressibility introduces additional complexities, including the stagnation enthalpies of the two streams, and admits influences of higher acoustical modes. GRA

N88-15160# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLOW IN CENTRIFUGAL COMPRESSORS
1987 591 p Lecture series held in Rhode-Saint-Genese, Belgium, 19-23 Jan. 1987
(VKI-LS-1987-01; ISSN-0377-8312; ETN-88-91158) Avail: NTIS HC A25/MF A01

Progress in centrifugal compressor design and optimization is reviewed, emphasizing unsteady flow and component vibration. Measurement techniques and performance prediction methods are also discussed. Blade vibrations due to unsteady flow, rotor flow stability, flow in labyrinth seals, and flow in volutes are treated. For individual titles, see N88-15161 through N88-15170.

N88-15161# Cranfield Inst. of Tech., Bedford (England). School of Mechanical Engineering.
MEASUREMENTS IN CENTRIFUGAL COMPRESSORS
R. L. Elder and C. P. Forster *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 85 p
(For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

Flow in centrifugal compressors is presented. The history of measurements in centrifugal compressors is traced back to 1902. Measurement techniques are reviewed and the flow phenomena appearing from experimental observation are discussed. ESA

N88-15162# Cranfield Inst. of Tech., Bedford (England). School of Mechanical Engineering.
CENTRIFUGAL COMPRESSORS
R. L. Elder and C. P. Forster *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 89 p
(For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

Design of centrifugal compressors and performance prediction methods are presented. Impeller work equation, impeller velocity triangles, impeller sweepback, overall pressure rise characteristics, surges, and design analysis are treated. ESA

N88-15163# Concepts ETI, Inc., Norwich, Vt.
THE TECHNOLOGY OF CENTRIFUGAL COMPRESSORS: A DESIGN APPROACH AND NEW GOALS FOR RESEARCH c37
D. Japikse *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 70 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

Advances in industrial centrifugal compressor technology and their possible future evolution are discussed. It is shown that one dimensional models are solved successfully and that good results are obtained with three dimensional computation. The examination of data reveals that data bases are still scant. The approximate level of constant rotor deviation can be considered acceptable only as a preliminary assumption and improvements are necessary. ESA

N88-15164# Texas A&M Univ., College Station. Dept. of Turbomachinery.
IDENTIFICATION AND AVOIDANCE OF INSTABILITIES IN HIGH PERFORMANCE TURBOMACHINERY
Dara Childs *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 76 p (For primary document

see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

Factors involved in turbomachine unstable subsynchronous motion are reviewed. The characteristics of unstable motion are analyzed and the problems associated with flow stability are discussed. The expected frequency of unstable motion is determined. The elements of the machine which give rise to unstable motion are identified. The prospects for the design of stable high performance turbomachinery are examined. ESA

N88-15165# Technische Univ., Hanover (West Germany). Inst. fuer Stroemungsmachinen.
BLADE VIBRATION PROBLEMS IN CENTRIFUGAL COMPRESSORS. FUNDAMENTAL CONSIDERATIONS c37
U. Haupt *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 26 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

The fundamental vibration characteristics of radial blades and the problem of signal transmission during experimental investigations are investigated. The computation of static and dynamic stress is discussed, presenting results and examples of application of the finite element method and the shallow shell theory. The interactions between vibrating blades are also studied. ESA

N88-15166# Technische Univ., Hanover (West Germany). Inst. fuer Stroemungsmachinen.
BLADE VIBRATION DUE TO DIFFERENT FLOW EXCITATION c37
U. Haupt *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 47 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

Results of experiments carried out at various excitation conditions, variations in geometry, and especially in diffuser flow conditions are presented. The analysis includes the study of blade resonance excitation, blade flutter, vibrations due to surge, and the investigation of blade modes during compressor operation. ESA

N88-15167# Technische Univ., Hanover (West Germany). Inst. fuer Stroemungsmachinen.
BLADE EXCITATION DUE TO UNSTEADY FLOW PHENOMENA c37
U. Haupt *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 35 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

Blade excitation due to different types of unsteady flow such as rotating stall, nonrotating stall, reverse flow, and surge are studied. Flow and blade vibration measurement systems are discussed. The blade response under periodic unsteady pressure patterns are investigated, as well as the response to random fluctuations. The broad band pressure fluctuations found in the frequency spectra are the result of a reversed flow near the shroud wall from the impeller outlet to the inlet. Reverse flow is shown to be a significant source of blade vibration. ESA

N88-15168# Sulzer-Escher Wyss Ltd., Zurich (Switzerland).
FLOW IN LABYRINTH SEALS AND ITS INFLUENCE ON ROTOR STABILITY OF TURBOCOMPRESSORS
H. R. Wyssmann *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 25 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

A theory based on a two volume bulk flow approach gives an agreement with measurements for cross coupling and damping of labyrinth seals. The theory incorporates results from a three dimensional finite difference calculation of the rotationally symmetric single cavity turbulent flow based on time averaged Navier Stokes equation. It is argued that simplified flow theories are necessary, since a full three-dimensional calculation of a single eccentric labyrinth chamber requires greater than 100 CPU hr on a VAX 9600. ESA

N88-15169# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
FLOW IN VOLUTES AND THE INFLUENCE ON THE FLOW IN CENTRIFUGAL COMPRESSORS
Mario Th. Sideris and R. A. VandenBraembussche *In its* Flow in Centrifugal Compressors (date) 87 p(SEE N88-15160 07-34) 1987 (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

The phenomenon of volute-impeller interactions is investigated. A study of the different parts of a centrifugal compressor (impeller, diffuser, volute) is carried out. The generation of perturbations and their upstream propagation is examined. Theoretical models to predict this phenomenon are evaluated. Measurements on a straight conical volute show that the swirling flow distribution consists of two parts: a low energy flow core of the forced vortex type and a high energy constant velocity swirl. An analytical model using Beltrami flows shows good agreement with measured results if a suitable velocity distribution along the volute cross section is used. ESA

N88-15170# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
NUMERICAL STUDY OF A CENTRIFUGAL IMPELLER RESPONSE TO A DOWNSTREAM STATIC PRESSURE PERTURBATION c37
Mario Th. Sideris *In its* Flow in Centrifugal Compressors (date) 39 p(SEE N88-15160 07-34) 1987 (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

The centrifugal impeller response to a downstream circumferential perturbation (volute presence) is examined to determine the basic parameters governing wave propagation and the unsteady flow in simplified channels. A theoretical prediction model is verified and extended to predict unsteady impeller response due to volute imposed circumferential pressure perturbations. ESA

N88-15171# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
VISCOUS DRAG REDUCTION OF HORIZONTAL PLATES
Ph. Schaus and R. Grundmann May 1987 15 p
(VKI-TN-159; ETN-88-91102) Avail: NTIS HC A03/MF A01

Methods of reducing the viscous drag created by a two dimensional laminar flow on a horizontal plate were developed. Within Prandtl's boundary layer theory, the two-dimensional dimensionless boundary layer equations were solved by a generalized Crank-Nicolson finite difference method. In order to reduce the integrated skin friction coefficient, a slightly disturbed outer velocity distribution was given to the plate. According to the first order boundary layer theory a wavy outer velocity distribution corresponds to a wavy surface. In the case of a two dimensional, laminar, and incompressible boundary layer with a sinusoidal outer velocity distribution, a reduction of 11 percent in the viscous drag can be achieved compared to that of the flat plate. ESA

N88-15172# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A METHOD FOR THE APPROXIMATE CALCULATION OF THE SKIN FRICTION COEFFICIENT OF HORIZONTAL WAVY PLATES
F. Nagel and R. Grundmann May 1987 12 p
(VKI-TN-160; ETN-88-91103; D/0238/338) Avail: NTIS HC A03/MF A01

A method for a simple and approximate calculation of the wall shear stress distribution in a steady, two dimensional, laminar and incompressible boundary layer flow along a horizontal plate was developed. It is shown that for zero amplitude of oscillation the solution obtained by the approximation method is in very good agreement with Blasius' exact solution for flat plates. The method is useful for perturbations of 1 to 5 percent. For inviscid flow field

calculation where only the prediction of the point of separation is required, calculation time is less than that of integral methods.
ESA

N88-15173*# Institute for Scientific Computing, Fort Collins, Colo.
MULTITASKED EMBEDDED MULTIGRID FOR THREE-DIMENSIONAL FLOW SIMULATION Final Report
Gary M. Johnson, Julie M. Swisshelm, Daniel V. Pryor, and John P. Ziebarth Jun. 1986 8 p
(Contract NCC2-344; Grant AF-AFOSR-0289-85)
(NASA-CR-182398; NAS 1.26:182398; AD-A185631; AFOSR-87-1287TR) Avail: NTIS HC A02/MF A01 CSCL 20D

This project explored fast algorithms for Euler and Navier-Stokes simulations. A particular issue pursued under the grant was the integration of an explicit three dimensional flow solver, embedded mesh refinements, a model equation hierarchy, multiple grid acceleration and extensive vectorization and multi-tasking. Several papers were produced during this effort including such titles as Multitasked embedded multigrid for three dimensional flow simulation and Multigrid approaches to the Euler equations. An efficient algorithm designed to be used for Navier-Stokes simulations of complex flows over complete configurations is described. The algorithm incorporates a number of elements, including an explicit three dimensional flow solver, embedded mesh refinements, a model equation hierarchy ranging from the Euler equations through the full Navier-Stokes equations, multiple grid convergence acceleration and extensive vectorization and multitasking for efficient execution on parallel processing supercomputers. Results are presented for a preliminary trial of the method on a problem representative of turbomachinery applications. Based on this performance data, it is estimated that a mature implementation of the algorithm will yield overall speedups ranging as high as 100. Author

N88-15174*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REYNOLDS-STRESS AND DISSIPATION RATE BUDGETS IN A TURBULENT CHANNEL FLOW
N. N. Mansour, J. Kim, and P. Moin (Stanford Univ., Calif.) Dec. 1987 41 p Submitted for publication
(NASA-TM-89451; A-87182; NAS 1.15:89451) Avail: NTIS HC A03/MF A01 CSCL 20D

The budgets for the Reynolds stresses and for the dissipation rate of the turbulence kinetic energy are computed using direct simulation data of a turbulent channel flow. The budget data reveal that all the terms in the budget become important close to the wall. For inhomogeneous pressure boundary conditions, the pressure-strain term is split into a return term, a rapid term, and a Stokes term. The Stokes term is important close to the wall. The rapid and return terms play different roles depending on the component of the term. A split of the velocity pressure-gradient term into a redistributive term and a diffusion term is proposed, which should be simpler to model. The budget data is used to test existing closure models for the pressure-strain term, the dissipation rate, and the transport rate. In general, further work is needed to improve the models. Author

N88-15175# National Bureau of Standards, Gaithersburg, Md. Center for Applied Mathematics.
SOME PERFORMANCE COMPARISONS FOR A FLUID DYNAMICS CODE
D. W. Lozier and R. G. Rehm Sep. 1987 20 p
(PB88-113709; NBSIR-87/3638) Avail: NTIS HC A03/MF A01 CSCL 20D

The 3D transient motion of a buoyancy-driven perfect gas in an enclosure is computed by a FORTRAN program (BF3D). A computation model for eventual inclusion in the program is under development. BF3D changes slowly, has a long lifetime, and is run fairly infrequently. BF3D runs on supercomputers, but newer mini-supercomputers appear to be suitable also and may be advantageous because of ease of access and usage. Comparisons of BF3D on selected supercomputers, mini-supercomputers, scientific workstations and conventional mainframes are presented for the purpose of making partial benchmark data available to the computing public. Author

N88-15176# National Bureau of Standards, Gaithersburg, Md. Center for Fire Research.
MIXING IN VARIABLE DENSITY, ISOTHERMAL TURBULENT FLOWS AND IMPLICATIONS FOR CHEMICALLY REACTING TURBULENT FLOWS
W. M. Pitts and T. Kashiwagi May 1987 47 p Sponsored by AFOSR, Bolling, AFB, D.C.
(PB88-110044; NBSIR-87/3550) Avail: NTIS HC A03/MF A01 CSCL 20D

The goal of the research was to improve the fundamental understanding of chemically reacting turbulent flow. The approach which was taken was to investigate mixing in variable density flows in order to better understand the role of local density fluctuations (which result from chemical heat release) on the turbulent mixing behavior. The development of experimental diagnostics having excellent spatial and temporal resolution is described. These techniques were utilized to investigate a wide range of mixing properties in variable density flows. GRA

N88-15177# Sandia National Labs., Albuquerque, N. Mex.
PROGRAMS FOR CALCULATING TRANSIENT DARCIAN FLOW THROUGH NON-UNIFORM MATERIALS
J. R. Banister Oct. 1987 54 p
(Contract DE-AC04-76DP-00789)
(DE88-001924; SAND-87-2101) Avail: NTIS HC A04/MF A01

Several programs were developed for calculating the flow of high pressure gases into porous material. Some of these programs should be of general interest, so they are presented in this report. A general format for numerically integrating the second order differential equation is first developed; various modifications are then made to allow both spatial and time variations of the specific permeability and/or porosity of the medium. The accuracy of the programs were checked by integrating to steady state solutions which can be specified analytically. Small time steps must be used to avoid numerical instabilities; a method for increasing this time step in the later stages of the calculation was developed.
DOE

N88-15178# Howard Univ., Washington, D. C.
NUMERICAL COMPUTATIONS OF NATURAL CONVECTION HEAT TRANSFER IN IRREGULAR GEOMETRIES Final Report
E. K. Glakpe 23 Jan. 1987 7 p
(Contract DE-FG05-84OR-21495)
(DE88-002358; DOE/OR-21495/T2) Avail: NTIS HC A02/MF A01

This report explains the determination of buoyancy driven flow characteristics and heat transfer in enclosures of complex geometrical shapes. Applications of buoyancy driven flows can be found in solar collector devices, energy conservation technologies, cooling of micro-electronic chips, and nuclear reactor spent fuel shipping configurations. The problem is further complicated when three dimensional effects, non-Boussinesq effects, turbulence, and heat transfer by radiation are accounted for in the overall balance of energy transfer. This study developed a capability to model and predict the heat transfer and flow characteristics in shipping cask configurations involving light water and fast reactor fuel assemblies. We explored the complex flow phenomena involved in these configurations to develop numerical prediction capabilities to obtain data for the design and/or thermal analysis of such shipping casks. DOE

N88-15179# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
RAYLEIGH-TAYLOR INSTABILITY IN COMPRESSIBLE FLUIDS Final Report, 1 Oct. 1986 - 30 Sep. 1987
B. Sturtevant Sep. 1987 9 p
(Contract W-7405-eng-48)
(DE88-002473; UCRL-15926-87) Avail: NTIS HC A02/MF A01

The purpose of this research program is to investigate fluid dynamic instabilities and mixing initiated by the interaction of shock waves with interfaces between light and heavy gases. In particular, the nonlinear stage of shock-initiated Rayleigh-Taylor instability, the secondary instabilities (e.g., the Kelvin-Helmholtz instability) arising therefrom and the concomitant mixing of the two gases are of interest. This report describes activities during the performance period 1 October 1986 to 30 September 1987.
DOE

N88-15180# Lawrence Livermore National Lab., Calif.
GROUND SHOCK PROFILES FOR AN ACCIDENTAL EXPLOSION AT THE PROPOSED LARGE ROCKET TEST FACILITY AT ARNOLD ENGINEERING DEVELOPMENT CENTER
B. C. Davis Jul. 1987 31 p
(Contract W-7405-eng-48)
(DE88-002652; UCID-21244) Avail: NTIS HC A03/MF A01

An assessment is made of the ground shock in profile which may be generated in the event of an accidental explosion at the proposed Large Rocket Test Facility (LRTF) at Arnold Engineering Development Center (AEDC). The assessment is accomplished by using previous results and by reviewing existing ground motion data at depth, for sites with similar geology to expected conditions at AEDC. Empirical relationships are developed from these data and used to predict the ground motion in profile. As indicated above, the surface ground motion predictions were developed and rely on an existing relationship to predict surface velocity. Empirical relationships developed in the course of the previous study predict surface acceleration and displacement. The empirical relationships developed are used to predict acceleration, velocity, and displacement at depth. The ground motions are presented in table form and as profile plots. The results of this and previous studies are intended to be used for evaluating the siting of the LRTF.
DOE

N88-15181# Fermi National Accelerator Lab., Batavia, Ill.
AN INVESTIGATION INTO FLOW REGIMES FOR TWO-PHASE HELIUM FLOW
J. C. Theilacker and C. H. Rode Oct. 1987 9 p Presented at the Conference on Advances in Cryogenic Engineering, St. Charles, Ill., 14 Jun. 1987 Prepared in cooperation with Continuous Electron Beam Accelerator Facility, Newport News, Va.
(Contract DE-AC02-76CH-03000)
(DE88-002834; FNAL-TM-1482; CONF-8706125-18) Avail: NTIS HC A02/MF A01

The Tevatron accelerator at Fermilab incorporates long two-phase helium passages. During magnet design, the generalized flow map of Baker was used to predict homogeneous flow. Longer than expected magnet time constants led to this investigation. The importance of predicting the flow regime has been amplified with the advent of non-horizontal accelerator designs. A test setup was constructed at Fermilab to investigate two-phase helium flow regimes for conditions practical in accelerator designs. The setup consisted of a standard Tevatron satellite refrigerator, subcooling dewar, heater, 35 m long transfer line, and a specialized end box. A knife blade on the midplane of the transfer line diverted the flow from the upper and lower halves of the pipe to separate vessels in the end box. The amount of liquid above and below the plane was measured at various total mass flow rates and liquid percentages. Results show that stratified flow occurs at much higher liquid percentages than predicted by the Baker diagram (several orders of magnitude). It was not possible to produce high enough steady state flows to find a boundary to a homogeneous flow regime. Stratified flow occurred over all practical conditions for long accelerator magnet systems.
DOE

N88-15182# National Center for Atmospheric Research, Boulder, Colo.
THIN FILM AND GRADIENT-DRIVEN INSTABILITY MECHANISMS Ph.D. Thesis
B. A. Nerad 1987 270 p Prepared in cooperation with Colorado Univ., Boulder
(Grant NSF ATM-82-17015)
(PB88-101522; NCAR/CT-108) Avail: NTIS HC A12/MF A01 CSCL 20D

A fundamental approach is sought to describe the generation of spontaneous free convection in thin liquid films and in liquid layers undergoing heat or mass transfer and not subject to external forces or surface tension gradients. A description of these instabilities employing the Burnett equations appears to be the most rigorous mathematical formulation. The Burnett equations description of a thin liquid film was found to admit the possibility of disjoining pressure, the driving force for the growth of interfacial instabilities in thin films. Also, the nonlinear constitutive relationships of the Burnett equations were found to provide an alternate driving force, distinct from those responsible for Marangoni and Rayleigh-Benard free convection, for the generation of spontaneous convection in liquid layers with temperature or concentration gradients. It is demonstrated that the mathematical description of the hydrodynamic stability problem for spontaneous free convection in thin films and for systems with steep gradients can be analogous in some cases due to a similar underlying cause of driving force for the fluid motion.
Author

N88-15183# Rocky Research Corp., Boulder City, Nev.
FEASIBILITY OF A COMPLEX COMPOUND HEAT PUMP Annual Report, Jul. 19886 - Jun. 1987
Uwe Rockenfeller Jul. 1987 63 p
(Contract GRI-5086-260-1251)
(PB88-113022; GRI-87/0223) Avail: NTIS HC A04/MF A01 CSCL 20D

A feasibility study is described of a double effect gas fired heat pump using ammoniated solid vapor complex compounds as the working media. The cycle takes advantage of the coordinative characteristics of complex compound ligand bonds resulting in large coordination spheres with only one degree of freedom. The cycle has high efficiency, no moving parts, and minimum electrical parasitic requirements. Fluid properties of candidate materials were measured with respect to vapor pressure equilibria, coordination properties and thermal stability. Preliminary reaction rate measurements were performed in adsorption and desorption processes. A computer model of double effect cycle was developed in order to predict the operating performance of the candidate complex compound media. The computer model was used to determine preliminary heat balances and coefficients of performance.
Author

N88-15184# Gas Research Inst., Chicago, Ill.
HEAT PUMP AND APPLIANCE RESEARCH Research Status Report, 1986 - 1987
Sep. 1987 120 p
(PB88-102462; GRI-87/0255) Avail: NTIS HC A06/MF A01 CSCL 20D

The areas of residential heating and cooling, residential heat pump and prime mover, commercial heat pump and prime mover, residential and commercial appliance, and building systems were examined. Project information provided include contractor, GRI project manager, objectives, results to data and status, and future plans. These research and development projects on gas end-use technology support GRI's objectives to develop improved gas using equipment that is more effective, meets environmental standards, and offers competitive consumer costs at equivalent or higher quality of service compared with alternative energy service options.
Author

N88-15185# Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Div. of Structural Engineering.
STATISTICAL ANALYSES OF MEASURED DIRECTIONAL WAVE AND CURRENT DATA
D. Karunakaran and N. Spidsoee 3 Feb. 1986 51 p Sponsored by Royal Norwegian Council for Scientific and Industrial Research, Oslo
(PB87-144523; STF71-A86006; ISBN-82-595-4238-2; Rept-4.16)
Avail: NTIS HC E04/MF E04 CSCL 20D

Results from statistical analyses of measured wave and current data. The analyses included directionality analyses, evaluation of transfer functions between surface elevation and water particle velocity and investigation of the probabilistic nature of the wave and current processes. The purpose is to investigate the validity of linear wave theroy. The conclusions are that linear wave theroy is sloightly conservative for prediction of structura; response in moderate sea states. For high sea states, further studied ware needed before any statement may be given. GRA

N88-15186*# Arizona State Univ., Tempe. Dept. of Electrical and Computer Engineering.
INTERIOR IMPEDANCE WEDGE DIFFRACTION WITH SURFACE WAVES Semiannual Report, 1 Aug. 1987 - 31 Jan. 1988
Constantine A. Balanis and Timothy Griesser Jan. 1988 36 p (Grant NAG1-562)
(NASA-CR-182405; NAS 1.26:182405) Avail: NTIS HC A03/MF A01 CSCL 20D

The exact impedance wedge solution is evaluated asymptotically using the method of steepest descents for plane wave illumination at normal incidence. Uniform but different impedances on each face are considered for both soft and hard polarizations. The asymptotic solution isolates the incident, singly reflected, multiply reflected, diffracted, and surface wave fields. Multiply reflected fields of any order are permitted. The multiply reflected fields from the exact solution are written as ratios of auxiliary Maliuzhinets functions, whereas a geometrical analysis gives the reflected fields as products of reflection coefficients. These two representations are shown to be identical in magnitude, phase and the angular range over which they exist. The diffracted field includes four Fresnel transition functions as in the perfect conductor case, and the expressions for the appropriate discontinuities at the shadow boundaries are presented. The surface wave exists over a finite angular range and only for certain surface impedances. A surface wave transition field is included to retain continuity. Computations are presented for interior wedge diffractions although the formulation is valid for both exterior and interior wedges. Author

N88-15187# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
USE OF A LOCAL HEAT SOURCE FOR DETERMINING TEMPERATURE OF INLET HEAT SECTION IN RING CHANNELS
V. S. Golba, Yu. I. Orlov, E. I. Chernetskij, and V. I. Rachkov 1986 12 p In RUSSIAN
(DE88-700332; FEI-1805) Avail: NTIS (US Sales Only) HC A03/MF A01

A numerical method to obtain the temperature field for the inner wall of an annular channel behind a local heat source place on the same wall from the source is described. Experimental data on temperatures of the inner wall of the annular channel around the local heat source are presented. Nu numbers for the initial section of the inner wall of the annular channel, when the constant heat flux from this surface being presented, as an example of concrete application of the methods suggested are calculated. DOE

N88-15188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERNAL FLUID MECHANICS RESEARCH ON SUPERCOMPUTERS FOR AEROSPACE PROPULSION SYSTEMS
Brent A. Miller, Bernhard H. Anderson, and John R. Szuch Jan. 1988 17 p Prepared for presentation at the 3rd International Conference on Supercomputing (ICS '88), Boston, Mass., 15-20 May 1988; sponsored by International Supercomputing Inst., Inc.
(NASA-TM-100289; E-3937; NAS 1.15:100289) Avail: NTIS HC A03/MF A01 CSCL 20D

The Internal Fluid Mechanics Division of the NASA Lewis Research Center is combining the key elements of computational fluid dynamics, aerothermodynamic experiments, and advanced computational technology to bring internal computational fluid mechanics (ICFM) to a state of practical application for aerospace propulsion systems. The strategies used to achieve this goal are to: (1) pursue an understanding of flow physics, surface heat transfer, and combustion via analysis and fundamental experiments, (2) incorporate improved understanding of these phenomena into verified 3-D CFD codes, and (3) utilize state-of-the-art computational technology to enhance experimental and CFD research. Presented is an overview of the ICFM program in high-speed propulsion, including work in inlets, turbomachinery, and chemical reacting flows. Ongoing efforts to integrate new computer technologies, such as parallel computing and artificial intelligence, into high-speed aeropropulsion research are described. Author

N88-15189*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUMERICAL SOLUTION OF TURBULENT FLOW PAST A BACKWARD FACING STEP USING A NONLINEAR K-EPSILON MODEL Final Report
C. G. Speziale and Tuan Ngo (Georgia Inst. of Tech., Atlanta.) Dec. 1987 46 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178421; ICASE-87-74; NAS 1.26:178421) Avail: NTIS HC A03/MF A01 CSCL 20D

The problem of turbulent flow past a backward facing step is important in many technological applications and has been used as a standard test case to evaluate the performance of turbulence models in the prediction of separated flows. It is well known that the commonly used kappa-epsilon (and K-l) models of turbulence yield inaccurate predictions for the reattachment points in this problem. By an analysis of the mean vorticity transport equation, it will be argued that the intrinsically inaccurate prediction of normal Reynolds stress differences by the Kappa-epsilon and K-l models is a major contributor to this problem. Computations using a new nonlinear kappa-epsilon model (which alleviates this deficiency) are made with the TEACH program. Comparisons are made between the improved results predicted by this nonlinear kappa-epsilon model and those obtained from the linear kappa-epsilon model as well as from second-order closure models. Author

N88-15190# Virginia Univ., Charlottesville. Dept. of Applied Mathematics.
NUMERICAL METHODS FOR FLUID FLOW PROBLEMS
L. E. Mansfield Sep. 1987 8 p
(Contract DE-FG05-87ER-25031)
(DE88-000156; DOE/ER-25031/1; UVA-527355/AM88/101)
Avail: NTIS HC A02/MF A01

This report presents results in computer modeling of fluid flow. Problems treated are: time-splitting methods applied to pipe flow and the backward facing step; sparse positive definite linear equation solutions on the hypercube processor; and investigation of the conjugate residual method to solve momentum equations. DOE

N88-15191# Los Alamos National Lab., N. Mex.
THE KIVA-2 COMPUTER PROGRAM FOR TRANSIENT MULTIDIMENSIONAL CHEMICALLY REACTIVE FLOWS WITH SPRAYS
A. A. Amsden, T. D. Butler, and P. J. ORourke 1987 18 p Presented at the International Fuels and Lubricants Meeting and Exposition, Toronto, Ontario, 2 Nov. 1987
(Contract W-7405-eng-36)
(DE88-000502; LA-UR-87-3015; CONF-871142-4) Avail: NTIS HC A03/MF A01

Since its public release in 1985, the KIVA computer program has been utilized for the time dependent analysis of chemically reacting flows with sprays in two and three space dimensions. This paper describes some of the improvements to the original version that have been made since that time. The new code called KIVA-2 is planned for public release in early 1988. KIVA-2 improves the earlier version in the accuracy and efficiency of the computational procedure, the accuracy of the physics submodels, and in versatility and ease of use. Numerical improvements include

the use of the ICE solution procedure in place of the acoustic subcycling method and the implementation of a quasi-second-order-accurate convection scheme. Major extensions to the physical submodels include the inclusion of an optional kappa-epsilon turbulence model, and several additions to the spray model. We illustrate some of the new capabilites by means of example solutions. DOE

N88-15192# Delaware Univ., Newark. Dept. of Chemical Engineering.
THE GENERALIZED VAN DER WAALS THEORY OF PURE FLUIDS AND MIXTURES Annual Report, Dec. 1986 - Nov. 1987
S. I. Sandler 1987 8 p
(Contract DE-FG02-85ER-13436)
(DE88-002380; DOE/ER-13436/T1) Avail: NTIS HC A02

The objective of the work is to use the generalized van der Waals theory as derived earlier to: (1) understand the molecular level assumptions inherent in current thermodynamic models; (2) use theory and computer simulation studies to test these assumptions; and (3) develop new, improved thermodynamic models based on better molecular level assumptions. From this fundamental study, thermodynamic models are being developed that will be applicable to mixtures of molecules of widely different size and functionality, as occurs in the processing of heavy oils, coal liquids and other synthetic fuels, and in biological separations. An important aspect of the work is to reduce fundamental theoretical developments to engineering practice through extensive testing and evaluation with experimental data on real mixtures. DOE

N88-15193# Sandia National Labs., Albuquerque, N. Mex.
THE EFFECT OF ASYMMETRIC HEATING ON FLOW STABILITY AND HEAT TRANSFER FOR FLOW IN A VERTICAL TUBE
C. H. Tappan Nov. 1987 62 p
(Contract DE-AC04-76DP-00789)
(DE88-003242; SAND-87-1787) Avail: NTIS HC A04/MF A01

Experimental results of combined free and forced convection heat transfer in a vertical tube with a circumferentially nonuniform constant wall heat flux are presented. The effect of an asymmetric wall heat flux on flow stability and on the rate of heat transfer for water flowing downward in a vertical tube was investigated. Experimental results were used to develop two stability maps which identify various flow regimes, corresponding to different thermal and hydraulic conditions. Heat transfer coefficients were also determined. Experimental results in the present investigation were compared to those with uniform heating in horizontal and vertical tube flow situations discussed in the literature. DOE

N88-15194# Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
AN EXPLICIT METHOD FOR THE SOLUTION OF THE EULER EQUATIONS, APPLIED TO UNSTEADY TWO DIMENSIONAL FLOWS Ph.D. Thesis [EINE EXPLIZITE METHODE ZUR LOESUNG DER EULERGLEICHUNGEN ANGEWANDT AUF INSTATIONAERE EBENE STROEMUNGEN]
Marie-Ronald Deslandes 1986 157 p In GERMAN
(ETN-88-90807) Avail: NTIS HC A08/MF A01

A purely explicit method for the numerical treatment of unsteady flows, using the Euler equations, was developed. The unsteady Euler equations were deduced for fully general spatial flows in body-adapted curvilinear coordinates, allowing the description of any dynamic phenomenon, as well as flows about time-varying contours. The numerical examples for typical two-dimensional profile flows with Mach numbers between 0 and 20 demonstrate the usefulness and limitations of the method, and show good agreement with theory in many cases. The solution of three-dimensional cases requires more computer capacity. ESA

N88-15195# British Aerospace Public Ltd. Co., Stevenage (England). Space and Communications Div.
ORBITAL REPLACEABLE UNIT (ORU)/COLD PLATE THERMAL INTERFACE STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
D. Nikanpour, comp. Paris, France ESA Apr. 1987 27 p
(Contract ESTEC-6467/85-NL-AN)
(BAe-TP-8430; ESA-CR(P)-2456; ETN-88-91151) Copyright
Avail: NTIS HC A03/MF A01

A pressurized dry heat pipe connector concept and low melting point alloy interface material were compared for thermal control of high power orbit replaceable payloads. The use of the pressurized contact concept for improving the efficiency of a dry thermal interface has considerable advantages over other methods of mechanical clamping, particularly where large contact areas are required for the transfer of high heat fluxes. Moderate values for the joint conductance, up to 1000 W/sq m K are attainable. A cylindrical or conically shaped contact surface where connector heat pipes are pressed together in a radial direction can transfer high heat fluxes in relatively small sized thermal connectors. It also enables passive back-up concepts such as the low melting point alloy interface material to be integrated in the connector design. Tests show it is possible to achieve values of 7000 W/sq m K with the proposed thermal interface concept. ESA

N88-14927*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL FLUID DYNAMICS OVERVIEW
Percy J. Bobbitt *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 5-24 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

N88-14933*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUMERICAL SIMULATION OF A CONTROLLED BOUNDARY LAYER
Thomas A. Zang and M. Yousuff Hussaini *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 137-152 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

N88-14942*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BOUNDARY LAYER TRANSITION
L. Maestrello, A. Bayliss, S. M. Mangalam, and M. R. Malik (High Technology Corp., Hampton, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 333-345 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

N88-14944*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEPARATED FLOW
W. L. Sellers, III, R. E. Dunham, Jr., W. L. Goodman, F. G. Howard, R. J. Margason, D. H. Rudy, C. L. Rumsey, H. P. Stough, III, and J. L. Thomas *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 361-374 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

N88-14950*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT RESEARCH ON NATURAL LAMINAR FLOW
B. J. Holmes, C. C. Croom, E. C. Hastings, Jr., C. J. Obara, and C. P. vanDam (Vigyan Research Associates, Inc., Hampton, Va.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 461-474 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

N88-14952*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LAMINAR FLOW INTEGRATION: FLIGHT TESTS STATUS AND PLANS
R. D. Wagner, D. F. Fisher, M. C. Fischer, D. W. Bartlett, and R. R. Meyer, Jr. (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 485-518 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

N88-14953*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ROUGHNESS AND WAVINESS REQUIREMENTS FOR LAMINAR FLOW SURFACES
Clifford J. Obara (PRC Kentron, Inc., Hampton, Va.) and Bruce J. Holmes *In its* Langley Symposium on Aerodynamics, Volume 1 Dec. 1986 p 519-537 (For primary document see N88-14926 07-01)
Avail: NTIS HC A25/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N88-15196*# Alabama Univ., Huntsville.
PERSONNEL OCCUPIED WOVEN ENVELOPE ROBOT POWER Semiannual Report
30 Nov. 1987 115 p Prepared in cooperation with Pace and Waite, Inc., Huntsville, Ala. and Wyle Labs., Inc., Huntsville, Ala.
(Grant NAGw-847)
(NASA-CR-182367; NAS 1.26:182367) Avail: NTIS HC A06/MF A01 CSCL 14B

The Human Occupied Space Teleoperator (HOST) system currently under development utilizes a flexible tunnel/Stewart table structure to provide crew access to a pressurized manned work station or POD on the space station without extravehicular activity (EVA). The HOST structure facilitates moving a work station to multiple space station locations. The system has applications to orbiter docking, space station assembly, satellite servicing, space station maintenance, and logistics support. The conceptual systems design behind HOST is described in detail. J.P.B.

N88-15197# Rome Univ. (Italy). Dipt. di Fisica.
CALIBRATION CONSTANTS FOR THE 1986 BGO CRYSTALS MATRIX
F. Ferroni and E. Longo 19 Jun. 1987 50 p
(Nota-Interna-886; ETN-88-91247) Avail: NTIS HC A03/MF A01

It is shown that it is possible to control the stability of the energy calibration of the detector at a level which matches its performance. The best energy resolution observed in a prototype of the detector is of the order of 0.5 percent. The pedestal calculation method, beam momentum knowledge, (pre)amplifier gain recalibration, temperature sensor utilization, and status of the 10 * 10 matrix in terms of bad channels are reviewed. The method used for taking into account the correction due to light collection efficiency which changes the crystal light yield as a function of the uniformity and energy is outlined. Calibration constant dependence on sample size, temperature, energy, integration length and time stability is shown. Calorimeter energy resolution and the requirement for the half barrel enterprise are considered. ESA

N88-15198# Rome Univ. (Italy). Dipt. di Fisica.
IONIZATION LOSSES IN BGO
M. Diemoz and W. Walk (European Organization for Nuclear Research, Geneva, Switzerland) 9 Jul. 1987 16 p
(Nota-Interna-889; ETN-88-91250) Avail: NTIS HC A03/MF A01

A precise measurement of the most probable ionization loss by pions in BGO was performed in the momentum range 2 to 50 GeV/c. The corresponding average energy losses are derived from these measurements. The results agree with theoretical predictions with the error of measurement, which is generally less than or = 0.5 percent statistically, with an overall systematic error of + or - 2 percent. The results obtained for pions can be easily converted to get the dEa/dx of muons in BGO and are of particular importance to monitor the calibration stability in situ of the final L3 electromagnetic calorimeter. ESA

N88-15199# Crites Enterprises, Saint Louis, Mo.
THIN FILM ELECTRET BOUNDARY LAYER TRANSITION DETECTOR: A FEASIBILITY STUDY Final Report, 22 Jul. 1986 - 22 Jan. 1987
Roger C. Crites Sep. 1987 47 p
(Contract F40600-86-C-0006)
(AD-A185675; AEDC-TR-87-25) Avail: NTIS HC A03/MF A01 CSCL 14B

Research was conducted to determine the feasibility of developing an economical non-intrusive boundary layer transition detector. The new detector would be a thin (0.001 to 0.003 inch) plastic film with a large imbedded array of miniature fluctuating pressure transducers. Bonded to the aerodynamic surface of interest, the detector would yield a detailed map of fluctuating surface pressure. Turbulent bursts in the transitional region result in a characteristic peak in local surface pressure fluctuation. Transition would be located by resolving this peak. During this task, prototype transition detectors were fabricated. Thin film electret pressure transducer elements were used to perform proof of concept testing in the University of Missouri-Rolla subsonic wind tunnel. The result of this wind tunnel test verifies the feasibility of developing thin film arrays of fluctuating pressure transducers, and of using these arrays to determine the location of boundary layer transition. Additional work is being planned to develop the technology necessary to allow rapid economical production of fluctuating pressure transducer arrays of almost any desired pattern and density. GRA

N88-15200# Lawrence Livermore National Lab., Calif.
FABRICATION TECHNIQUES USED IN THE CONSTRUCTION OF A HIGH RESOLUTION X-RAY FRAMING CAMERA
W. M. Cook and D. G. Stearns Oct. 1987 24 p
(Contract W-7405-eng-48)
(DE88-002653; UCID-21225) Avail: NTIS HC A03/MF A01

A high resolution X-ray framing camera (HRXFC) has been developed for use as a diagnostic tool for laser fusion experiments that is capable of recording a two-dimensional radiographic snapshot of an imploding fusion target with a shutter speed of less than 100 ps. Recent tests of a complete prototype instrument have demonstrated frame durations as short as 40 ps FWHM. The HRXFC is based on a gated 15-ohm strip transmission line. Into this stripline are imbedded various elements, both active and inactive, that must perform their respective functions while having a negligible impact on the electrical characteristics of the transmission line. A discussion of the theory of operation of the HRXFC is presented along with an introduction to the elements of the stripline and their functions. This is followed by a discussion of the special techiques used to fabricate the instrument. DOE

N88-15201# Fermi National Accelerator Lab., Batavia, Ill.
ONLINE MONITORING OF LASERPULSES USING THE GPIB-INTERFACE OF A TEKTRONIX 2430 DIGITAL STORAGE OSCILLOSCOPE
L. Verluyten and M. W. Peters Oct. 1987 15 p
(Contract DE-AC02-76CH-03000)
(DE88-002836; FNAL-TM-1484) Avail: NTIS HC A03/MF A01

One of the monitoring aspects of holography at the 15 foot Bubble Chamber is the online checking of the light output of the JK2000 ruby laser. Ideally the light output should be a squared

pulse in time. Spikes, pre- and postlasing (i.e., lasing before and after the squared pulse) can have a negative influence on the holograms. The scheme for monitoring the light output is discussed in this paper as well as the programming codes and experimental setup necessary to enhance the holography. DOE

N88-15202# Zhengzhou Univ. (China). Dept. of Welding.
SYNCHRONOUS MULTI-IMAGE HIGH SPEED PHOTOGRAPHY OF WELDING ARC BY OPTICAL FIBERS
Z. Sun 1986 9 p Sponsored by the Institute of Scientific and Technical Information of China, Beijing
(PB87-143939; ISTIC-TR-C-000077) Avail: Issuing Activity
CSCL 14E

A new method for investigating welding arcs is provided by the combination of high speed photography with optical fibers. It enables high speed phenomena to be observed and analyzed from several directions simultaneously, thus promoting a comprehensive understanding of the process under research. It is believed that the new method will find a wide range of application in other spheres of scientific research into welding techniques. GRA

N88-15203# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR).
SCANNING AND MEASURING PECULIARITIES WITH HIGH-SPACE RESOLUTION OBJECTS RECORDED AT THE GABOR HOLOGRAMS
Yu. A. Belokopytov, A. P. Vorobev, and V. A. Goncharov 1986 8 p In RUSSIAN; ENGLISH summary
(DE88-700373; IFVE-OEA-OEIPK-86-106) Avail: NTIS (US Sales Only) HC A02/MF A01

Peculiarities of scanning and measurement of Gabor holograms, generated with the NOVS heavy-liquid holographic chamber used as a vertex detector in high energy physics are considered. It is shown that an optical TV scheme with projecting the cross section of the reconstructed three-dimensional image on the TV chamber vidicon and its display on the TV-monitor screen, using subsequently optical and TV magnification may be recommended for processing the events of high spatial resolution recorded on Gabor holograms. A method of precise sighting using measuring cross lines projected on the TV-chamber vidicon is recommended for coordinate measuring in the XY plane parallel to the hologram, a method for the best focusing onto the plane is advisable for z-coordinate measurement. Estimation of the error when determining z-coordinate of a bubble 5 microns in diameter makes up 20 microns at optical magnification equal to 8 and 70 microns at optical magnification equal to 1. DOE

N88-15204# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
MULTICHANNEL ELECTRON COUNTER WITH HIGH SPACE RESOLUTION
V. N. Polishchuk, N. G. Shevchenko, V. M. Denyak, Yu. V. Vladimirov, and B. V. Mazanko 1987 7 p In RUSSIAN
(DE88-700564; KFTI-87-5) Avail: NTIS (US Sales Only) HC A02/MF A01

A multichannel scintillation counter of electrons with high space resolution delta = 5.8 x 0.0001 is developed to detect high-energy electrons at the output from the SP-95 magnetic spectrometer. A mechanism and control unit permitting to establish automatically detectors at the best focusing point according to the given parameters, and to use the best resolution of the spectrometer are developed. The counter is made on the base of PM-87 and PM-30 temporary photomultipliers. DOE

N88-15205# Fermi National Accelerator Lab., Batavia, Ill.
SINGLE WIRE DRIFT CHAMBER DESIGN
J. Krider 30 Mar. 1987 35 p
(Contract DE-AC02-76CH-03000)
(DE87-011002; FNAL-TM-1455) Avail: NTIS HC A03

This report summarizes the design and prototype tests of single wire drift chambers to be used in Fermilab test beam lines. The goal is to build simple, reliable detectors which require a minimum of electronics. Spatial resolution should match the 300 micron rms resolution of the 1 mm proportional chambers that they will replace. The detectors will be used in beams with particle rates up to 20 KHz. Single track efficiency should be at least 99 percent. The first application will be in the MT beamline, which has been designed for calibration of CDF detectors. A set of four x-y modules will be used to track and measure the momentum of beam particles. DOE

N88-15206# Colorado School of Mines, Golden. Dept. of Chemical Engineering and Petroleum Refining.
AN AUTOMATED FLOW CALORIMETER FOR HEAT CAPACITY AND ENTHALPY MEASUREMENTS AT ELEVATED TEMPERATURES AND PRESSURES Progress Report, 1 Mar. 1987 - 29 Feb. 1988
V. F. Yesavage Oct. 1987 20 p
(Contract DE-FG02-87ER-13683)
(DE88-002357; DOE/ER-13683/1) Avail: NTIS HC A03/MF A01

The need for thermal property data at process conditions in the design of petrochemical and synfuel plants has been well documented. As such, the primary objective of this work is to construct an automated flow calorimeter to measure isobaric heat capacities and enthalpies of vaporization over the range 0 to 30MPa and 300 to 700K with an anticipated accuracy of 0.1%. The method of measurement is by the traditional electrical power input technique with a unique calorimeter design utilizing a concentric coil/radiation shield structure which minimizes heat loss errors and simplifies the replacement of plugged components. Flow generation is accomplished with a precision Ruska pump eliminating the need for on-line flow rate measurement. In addition, the proposed instrument will be fully automated minimizing the need for highly skilled operators which had previously been a severe limitation with this type of instrument. Significant progress has been made on the project this last year with the completion of construction of all major system hardware components and the associated automation electronics. Initial tests of the equipment are encouraging and no significant delays are foreseen in the completion of the apparatus. During the next year the automation and data acquisition software will be written and the completed unit will be tested with water. DOE

N88-15207# Varian Associates, Palo Alto, Calif.
INITIAL OPERATION OF A HIGH-POWER WHISPERING-GALLERY-MODE GYROTRON
K. Felch, L. Ives, E. Jongewaard, H. Jory, and S. Spang Oct. 1987 4 p
(Contract W-7405-eng-48)
(DE88-002500; UCRL-15925) Avail: NTIS HC A02

Varian has begun the development of a high-power gyrotron based on a whispering-gallery-mode interaction circuit. The first experimental tube has been designed to generate pulsed output powers up to 1 MW at a frequency of 140 GHz. The tube was also designed for CW operation at power levels of several hundred kilowatts. The overall design of the tube is discussed. Fabrication of the tube is nearing completion and initial tests on the tube will be carried out in the near future. DOE

N88-15593# Joint Publications Research Service, Arlington, Va.
MULTILAYER HOLOGRAPHIC FUNCTIONAL ELEMENT IN ANALOG-DIGITAL CONVERTER Abstract Only
N. N. Yevtikhiyev, D. I. Mirovitskiy, N. V. Rostovtseva, and O. B. Serov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 61 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1794-1800 Original language document was announced in IAA as A87-28462 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15609*# DePauw Univ., Greencastle, Ind. Dept. of Physics and Astronomy.
RESOLUTION OF HOLOGRAMS PRODUCED BY THE FLUID EXPERIMENT SYSTEM AND THE HOLOGRAPHY GROUND SYSTEM
Howard L. Brooks *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 21 p (For primary document see Summer Faculty Fellowship Program 21 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 14E

N88-15614*# Alabama Univ., Huntsville. Dept. of Applied Optics.
PATTERN RECOGNITION TECHNIQUES FOR FAILURE TREND DETECTION IN SSME GROUND TESTS
A. Choudry *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 29 p (For primary document see Summer Faculty Fellowship Program 29 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 14E

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N88-15208# Naval Research Lab., Washington, D.C.
THE RAYLEIGH-TAYLOR INSTABILITY IN ABLATIVELY ACCELERATED TARGETS WITH 1, 1/2 AND 1/4 MICROMETERS LASER LIGHT Interim Report, 1 Oct. 1986 - 22 Sep. 1987
Mark H. Emery, Jill P. Dahlburg, and John H. Gardner 22 Sep. 1987 29 p
(AD-A185945; AD-F000114; NRL-MR-6061) Avail: NTIS HC A03/MF A01 CSCL 20I

The results of a series of detailed numerical simulations are presented for the Rayleigh-Taylor instability in laser ablatively accelerated targets for a fairly wide range of initial conditions. It is shown that the Rayleigh-Taylor growth rate in an ablative environment is a strong function of the laser wavelength. For perturbation wavelengths about 3 times the inflight target thickness, the ratios of the numerical growth rates to the classical growth rates are of the order of 1/1.5, 1/2.5 and 1/3.5 for 1, 1/2 and 1/4 micrometer laser light respectively. The numerical results are in good agreement with the theoretical based on the ablative convection of vorticity away from the unstable ablation front. These results provide strong evidence for the viability of high aspect ratio shells in direct drive laser fusion. GRA

N88-15209# California Univ., Los Angeles.
HIGH REPETITION RATE ELECTRON BEAM RF-ACCELERATION AND SUB-MILLIMETER WAVE GENERATION VIA A FREE ELECTRON LASER Annual Progress Report, 15 Aug. 1986 - 14 Aug. 1987
N. C. Luhmann, Jr. and D. B. McDermott 14 Aug. 1987 18 p
(Contract N00014-84-K-0569)
(AD-A186066) Avail: NTIS HC A03/MF A01 CSCL 09C

Short electron pulses can even enhance Free Electron Lasers gain. First-order effects become dominant as the spatial extent of the electron pulse becomes much shorter than the radio frequency wavelength. A buncher cavity between the electron gun and accelerator can improve the quality of the accelerated beam. The buncher has two adjustable parameters, the input power and its phase with respect to the accelerator. The input power determines the bunching parameter, which is a measure of the extent of bunching. The buncher cavity's phase controls the phase at which the electron pulses enter the accelerator and thus far their final energy. In any Travelling Wave Interactions half of the beam gains energy while the other half loses energy. For synchronism of the beam with the wave the two terms exactly cancel and there is no net power transfer. Energy loss dominates gain when the beam is properly mistuned from synchronism. The enhancement scheme for the Cyclotron Autoresonant Maser, recognized as appropriate for any TWI, is to effectively suppress the electrons which are phased to gain energy by using the gyro-resonant properties of a FEL wiggler. This enhancement wiggler is distinct from the FEL wiggler. GRA

N88-15210# Science Applications International Corp., McLean, Va.
HIGHER HARMONIC GENERATION IN THE INDUCED RESONANCE ELECTRON CYCLOTRON MASER Interim Report
S. Riyopoulos, C. M. Tang, P. Sprangle, and B. Levush Sep. 1987 35 p Prepared in cooperation with Maryland Univ., College Park
(Contract DE-AI05-83ER-40117)
(AD-A186236; NRL-MR-6072) Avail: NTIS HC A03/MF A01 CSCL 09C

The operation of the induced resonance electron cyclotron (IREC) maser at Doppler upshifted cyclotron harmonics is studied. A set of fast-time averaged nonlinear equations of motion is derived for the particle motion near an arbitrary harmonic at any index of refraction. The small signal efficiency is computed analytically and the minimum current to start the cavity oscillations is obtained. The nonlinear equations of motion are integrated numerically. The interaction efficiency at the first few harmonics is found comparable to the efficiency at the fundamental. The sensitivity of the efficiency to the beam thermal spreads is minimized by the proper selection of the index of refraction. GRA

N88-15211# Naval Ocean Systems Center, San Diego, Calif.
LASER ACTION FROM SYN-(METHYL,METHYL) BIMANE Interim Technical Report, Sep. 1985 - Sep. 1986
Theodore G. Pavlopoulos, Joseph H. Boyer, Politzer, I. R., and Chun M. Lau 1986 14 p
(AD-A186314; TR-4-ONR) Avail: NTIS HC A03/MF A01 CSCL 09C

Under the flashlamp excitation from an aqueous solution of syn-(methyl, methyl) bimane laser action was observed at 504 nm. The absorption, fluorescence, and triplet-triplet absorption spectra of this compound were also recorded. This compound showed good photochemical stability. The laser action properties of these new laser dyes were compared with those of Coumarin 30. GRA

N88-15212# Lawrence Livermore National Lab., Calif.
LASER PROGRAM Annual Report, 1985
M. L. Rufer, ed. and P. W. Murphy, ed. Nov. 1986 702 p
(Contract W-7405-eng-48)
(DE87-011009; UCRL-50021-85) Avail: NTIS HC A99/MF A01

Presented are the unclassified activities and accomplishments of the Inertial Confinement Fusion (ICF) and Advanced Laser Development elements of the Laser Program at the Lawrence Livermore National Laboratory for 1985. The report is organized into major sections corresponding to principal technical activities. Section 1 provides an overview. Section 2 comprises work in target theory, design, and code development. Target development and fabrication and the related topics in materials science are contained in Section 3. Section 4 presents work in experiments and diagnostics and includes developments in data acquisition and management capabilities. In Section 5 laser system (Nova) operation and maintenance are discussed. Activities related to supporting laser and optical technologies are described in Section 6. Basic laser research and development is reported in Section 7. Section 8 contains the results of studies in ICF applications where the work reported deals principally with the production of electric power with ICF. Finally, Section 9 is a comprehensive discussion of work to date on solid state lasers for average power applications. DOE

N88-15213# Oak Ridge National Lab., Tenn.
400-nm PHOTOLUMINESCENCE OF A COLOR CENTER IN UNDOPED YAG GROWN UNDER REDUCING ATMOSPHERE

G. Wu, R. T. Williams, G. P. Williams, Jr., C. Y. Chen, and Y. Chen Aug. 1987 6 p Presented at the Topical Meeting on Tunable Solid State Lasers, Williamsburg, Va., 26 Oct. 1987 Prepared in cooperation with North Carolina State Univ., Raleigh; and Oak Ridge National Lab., Tenn.
(Contract DE-AC05-84OR-21400)
(DE88-001760; CONF-871060-2-Draft) Avail: NTIS HC A02/MF A01

We describe a color center in reduced YAG (yttrium aluminium garnet) which luminesces in a broad band centered around 400 nm with high quantum efficiency, 4 ns radiative lifetime, and comparatively small Stokes shift. DOE

N88-15214# Lawrence Livermore National Lab., Calif.
DESIGN OF THE BACKSCATTER SPECTROSCOPY SYSTEM FOR THE NOVA LASER FACILITY
G. L. Tietbohl, R. P. Drake, and P. E. Young Oct. 1987 6 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-48)
(DE88-001880; UCRL-96691; CONF-871007-48) Avail: NTIS HC A02

When laser light is focused onto a target, a number of mechanisms can reflect or scatter the light back through the focus lens. The Backscatter Spectroscopy System (BSS) is a diagnostic that measures the properties of this reflected or scattered light. Just before the main focus lens on each of the ten Nova arms is a KDP crystal array for converting the 1 micron laser light to shorter harmonic wavelengths. This array rotates approx. 10 deg about the beam axis to select the 351 nm wavelength where most of the experiments are run. The BSS consists of a fused silica plate inserted into one of the beam lines before the KDP array. The reflector plate is shaped like one of the array elements and is aligned with it to minimize the effects of diffraction. The plate is mounted in a mechanism to allow alignment, as well as rotation with the KDP array when the converted wavelength is changed. The plate is mounted 10 deg off normal so that light can be reflected out of the beam tube. Roughly 4 percent of target-reflected light reflects off this plate and is transported to an optics table where it is analyzed. To transport the light to the optics table, an alignment insensitive relay lens system is used with a vacuum cell and turning mirrors. The instrumentation on the table includes a 0.5 meter spectrometer with an optical streak camera for time-resolved spectral information, a small photodiode array for intensity data, and a film pack for beam structure and system alignment information. DOE

N88-15215# Lawrence Livermore National Lab., Calif.
CHAPTER 2: THRESHOLD FOR RAMAN CONVERSION OF FEL LASER PULSES IN THE ATMOSPHERE Final Report
A. Ori and M. Rokni 1987 50 p Prepared in cooperation with Hebrew Univ., Jerusalem (Israel)
(Contract W-7405-eng-48)
(DE88-002470; UCRL-15971) Avail: NTIS HC A03/MF A01

Transmission of a high intensity laser beam through the atmosphere can be affected by a variety of stimulated and parametric nonlinear processes. As a result, gain at other wavelengths will be generated along the propagation path of the beam. But the conversion of the original laser energy into other wavelengths is not the only result. Unless special measures are taken, the wavefront of the Raman shifted radiation will be determined by the turbulence in the atmosphere and by the aspect ratio of the gain medium. These processes will lead to beam divergences which can be significantly greater than the diffraction limit. As a result of these nonlinear processes, it will not be possible to efficiently propagate the beam unless proper measures are taken. Developing a quantitative model is especially important for determining the propagation characteristics of free electron laser pulses through the atmosphere. The objective of this research report is to present such a time dependent model for stimulated Raman conversion of short laser pulse propagating in the atmosphere and to calculate the threshold laser pulse energy and intensity for stimulated rotational Raman scattering as a function of wavelength, pulse width and beam diameter. DOE

N88-15216# Paris II Univ., Orsay (France). Lab. de l'Horloge Atomique.
STUDY AND CONSTRUCTION OF A COMPACT HYDROGEN MASER WITH A HIGH-DEGREE OF FREQUENCY STABILITY Final Report
C. Audoin Sep. 1986 53 p In FRENCH; ENGLISH summary
(PB87-151122) Avail: NTIS HC E04/MF E04 CSCL 20E

A frequency source with a degree of short and medium term stability currently achievable only with a hydrogen maser was built and examined. Three identical compact hydrogen clocks were simultaneously constructed and studied. The precise specifications desired included: reduced mass and space requirements, reduced electrical consumption including the capacity to run independently on an internal battery for short periods of time, capacity for operation and maintenance by nonspecialist users and a very high degree of short and medium term stability (between 100 and 10,000 sec). These requirements were met in all three masers, demonstrating the feasibility of manufacture on an industrial scale: a volume of 465 dm cubed, consumption in the neighborhood of 100 W in 24 V, laboratory measured stability of 1.6 x 10 to the minus 15th power/1,000 sec and better than 10 to the minus 14th power between 40 and 100,000 sec and microprocessor controlled display, recording and management of operating parameters. Author

N88-15217# Lawrence Livermore National Lab., Calif.
ON 1064 nm AND 350 nm LASER DAMAGE THRESHOLDS OF HIGH INDEX OXIDE FILMS DEPOSITED FROM ORGANIC SOLUTIONS AND SOLS
I. Thomas, J. Wilder, R. Gonzales, and D. George 30 Jun. 1987 14 p Presented at the Boulder Damage Symposium, Boulder, Colo., 26 Oct. 1987
(Contract W-7405-eng-48)
(DE88-001636; UCRL-95286; CONF-8710165-2) Avail: NTIS HC A03/MF A01

High index oxide coatings TiO2, Ta2O5, ZrO2 and HfO2 have been prepared from organic solutions of metal organic precursors or from colloidal oxide suspensions. Room temperature processing gives porous coatings of comparatively low index (1.8 to 1.9). Heat treatments can, in some cases, increase the index. Laser damage threshold levels at 1064 nm with a single 1 ns pulse are in the range 6 to 10 J/sq cm. Lower figures are obtained at 350 nm with a 25 ns pulse under multishot (25 Hz) conditions. DOE

N88-15218# Lawrence Livermore National Lab., Calif.
LAWRENCE LIVERMORE NATIONAL LABORATORY SOFT X-RAY LASER PROGRAM Progress Report
J. Trebes, S. Brown, E. M. Campbell, N. Ceglio, D. Eder, D. Gaines, A. Hawryluk, C. Keane, R. London, and B. MacGowan et al. Aug. 1987 14 p Presented at the Society of Photo-Optical Instrumentation Engineers Meeting, San Diego, Calif., 17 Oct. 1987
(Contract W-7405-eng-48)
(DE88-001888; UCRL-96365; CONF-8710204-1) Avail: NTIS HC A03/MF A01

Significant progress toward the goal of producing high power, high coherence x-ray lasers has been made. Lasing at wavelengths as low as 66 A has been achieved in a nickel like laser scheme which is scalable to sub-44 A wavelengths. In addition, x-ray laser cavities, x-ray holography, and an applications beamline have been demonstrated. DOE

N88-15219# California Univ., Berkeley. Lawrence Berkeley Lab.
PHASE CONTROL OF THE MICROWAVE RADIATION IN FREE ELECTRON LASER TWO-BEAM ACCELERATOR
Y. Goren and A. M. Sessler Jul. 1987 9 p Presented at the Workshop on New Developments in Particle Acceleration Techniques, Orsay, France, 29 Jun. 1987
(Contract DE-AC03-76SF-00098)

(DE88-001460; LBL-23798; CONF-8706147-12) Avail: NTIS HC A02

A phase control system for the free electron laser (FEL) portion of a Two-Beam Accelerator is proposed. The control keeps the phase error within acceptable bounds. The control mechanism is analyzed, both analytically in a resonant particle approximation and numerically in a multi-particle simulation code. Sensitivity of phase errors to the FEL parameters has been noticed. DOE

N88-15220# Lawrence Livermore National Lab., Calif.
DEVELOPMENT OF COMPOSITE POLYMER-GLASS EDGE CLADDINGS FOR NOVA LASER DISKS
J. H. Campbell, G. Edwards, F. A. Frick, D. S. Gemmell, B. M. Gim, K. S. Jancaitis, E. S. Jessop, M. K. Kong, R. E. Lyon, and J. E. Murray Oct. 1987 24 p Presented at the Boulder Damage Symposium, Boulder, Colo., 26 Oct. 1987
(Contract W-7405-eng-48)
(DE88-002389; UCRL-95285; CONF-8710165-3) Avail: NTIS HC A03/MF A01

Large Nd:glass laser disks for disk amplifiers require an edge cladding which absorbs at 1 micron. This cladding prevents edge reflections from causing parasitic oscillations that would otherwise deplete the gain. We have developed a composite polymer-glass edge cladding that consists of absorbing glass strips bonded to the edges of laser glass disks using an epoxy adhesive. The edge cladding must survive a fluence of approximately 20 J/sq cm in a 0.5-ms pulse. Failure can occur either by decomposition of the polymer or by mechanical failure from thermal stresses which leads to bond delamination. An epoxy has been developed that gives the required damage resistance, refractive index match and processing characteristics. A slight tilt of the disk edges greatly reduces the threat from parasitic oscillations and a glass surface treatment is used to promote bond adhesion. Laser disks fabricated with this new cladding show identical gain performance to disks using conventional fused-glass cladding and have been tested for over 2000 shots (equivalent to about a 4-year lifetime on Nova) without degradation. DOE

N88-15578# Joint Publications Research Service, Arlington, Va.
TIME CHARACTERISTICS OF TRAVELLING WAVE LASING WITH TWO-PHOTON PICOSECOND OPTICAL PUMPING Abstract Only
V. I. Prokhorenko and Ye. A. Tikhoncv *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 19 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1848-1858 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15579# Joint Publications Research Service, Arlington, Va.
INCREASING TIME RESOLUTION OF PICOSECOND ABSORPTION SPECTROMETER BY SELECTION OF LENGTH OF LASER LIGHT PULSES Abstract Only
B. N. Korvatovskiy, V. V. Gorokhov, S. L. Logunov, and V. Z. Pashchenko *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 20 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1815-1819 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15580# Joint Publications Research Service, Arlington, Va.
DYNAMIC RESTRUCTURING OF PULSED CO2 LASER FREQUENCY AND MULTIPLE-PEAK GENERATION IN A CELL WITH IR-ABSORBING GAS IN THE RESONATOR Abstract Only
G. N. Makarov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 20-21 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1801-1807 Original language document was announced in IAA as A87-28463 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15581# Joint Publications Research Service, Arlington, Va.
CAUSES AND DISTRIBUTION OF FAILURES IN SEMICONDUCTOR LASERS (A REVIEW) Abstract Only
P. G. Yeliseyev *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 21 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1749-1769 Original language document was announced in IAA as A87-28460 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15582# Joint Publications Research Service, Arlington, Va.
STUDY OF VIBRATION RELAXATION IN ACTIVE MEDIUM OF CO2-LASER USING PHASE-ABSORPTION METHOD Abstract Only
B. F. Kuntsevich, A. N. Pisarchik, and V. V. Churakov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 22 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroscopii (Minsk, USSR), v. 44, no. 3, Mar. 1986 p 381-388 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15583# Joint Publications Research Service, Arlington, Va.
TEA-TE: POWERFUL NITROGEN-BASED LASER SYSTEM Abstract Only
Yu. V. Zvinevich, I. N. Kazimirchik, N. A. Nemkovich, A. N. Rubinov, and V. I. Tomin *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 23 Transl. into ENGLISH from Zhurnal Prikladnoy Spectroscopii (Minsk, USSR), v. 44, no. 3, Mar. 1986 p 509-511 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15584# Joint Publications Research Service, Arlington, Va.
INTRACAVITY SPECTRUM ANALYZER WITH NaF:F2(+):F3(-) CRYSTAL LASER FOR LONG-WAVE IR WAVE BAND Abstract Only
V. A. Vratskiy and A. N. Kolerov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 24 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroskopii (Minsk, USSR), v. 44, no. 4, Apr. 1986 p 576-580 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15585# Joint Publications Research Service, Arlington, Va.
STUDY OF KINETICS OF INTRACAVITY ABSORPTION IN PULSED DYE LASERS Abstract Only
V. S. Burakov, V. A. Malashonok, S. V. Nechayev, R. A. Pupko, S. N. Raykov, and S. I. Shedenkov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 25 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroskopii (Minsk, USSR), v. 44, no. 4, Apr. 1986 p 567-572 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15586# Joint Publications Research Service, Arlington, Va.
EFFECT OF MULTIPLICATION OF SPECTRAL COMPONENTS OF MULTI-FREQUENCY LASING OF PULSED TUNABLE LASER Abstract Only
V. I. Kravchenko and V. V. Taranov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 26 Transl. into ENGLISH from Pisma v Zhurnal Tekhnichesloy Fiziki (Leningrad, USSR), v. 12, no. 22, 26 Nov. 1986 p 1381-1385 Original language document was announced in IAA as A87-26407 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15587# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF LKI-501 TUNABLE DYE LASER WITH DYES IN SOLID MATRIX Abstract Only
A. I. Zhiltsov, A. G. Klimashina, V. Ye. Mnuskin, V. G. Nikiforov, A. N. Tokareva, and B. F. Trinchuk *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 27 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroskopii (Minsk, USSR), v. 45, no. 1, Jul. 1986 p 35-39 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15588# Joint Publications Research Service, Arlington, Va.
DYE LASER FOR HOLOGRAPHIC INTERFEROMETRY Abstract Only
I. S. Zeylikovich, A. M. Lyalikov, and N. M. Spornik *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 27-28 Transl. into ENGLISH from Kvantonaya Elektronika (Moscow, USSR), v. 13, no. 7, Jul. 1986 p 1386-1390 Original language document was announced in IAA as A87-24309 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15589# Joint Publications Research Service, Arlington, Va.
GENERATION OF LIGHT PULSES IN SEMICONDUCTOR LASER UPON EXCITATION BY SEVERAL ELECTRON BEAMS Abstract Only
K. V. Aleksandrovich, V. V. Druzhinin, V. A. Kovalenko, and M. D. Tarasov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 28-29 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 7, Jul. 1986 p 1336-1341 Original language document was announced in IAA as A87-24304 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15597# Joint Publications Research Service, Arlington, Va.
EXPLOSIVE ABSORPTION OF LASER BEAM OF FINITE DIAMETER Abstract Only
A. N. Orayevskiy and I. Ye. Protsenko *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 67 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 7, Jul. 1986 p 1467-1472 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15602*# Missouri Univ., Rolla. Dept. of Physics.
PROBLEMS AND POSSIBLE SOLUTIONS INVOLVED IN HARD TARGET CALIBRATION OF COHERENT DOPPLER LIDAR
Richard Anderson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 27 p (For primary document see Summer Faculty Fellowship Program 27 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N88-15221# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
FASTENING HIGH RESISTANCE BOLTS IN REAL ASSEMBLIES [LE SERRAGE DES BOULONS A HAUTE RESISTANCE DANS LES ASSEMBLAGES REELS]
P. Besem, E. Dehan (Ecole Nationale des Ponts et Chaussees, Paris, France), and E. Piraprez Jul. 1987 69 p In FRENCH Sponsored by Inst. pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture
(CRIF-MT-171; ETN-88-90729) Avail: NTIS HC A04/MF A01
Laboratory experiments combining torque control and angle control made in order to surpass the elasticity limit of bolts were continued in real conditions, on a metallic structure being assembled. The results obtained for different fastening procedures show that the results of torque controlled procedures differ significantly from the values observed in laboratory. The recommended mixed procedure is much less sensitive to operating variations. ESA

N88-15222*# SciTek Facilities, Huntsville, Ala.
RESEARCH STUDY FOR MATERIALS/PROPERTIES TEST RESULTS DATABASE Final Report, period ending 18 Feb. 1986
Feb. 1988 38 p
(Contract NAS8-35825)
(NASA-CR-178923; NAS 1.26:178923) Avail: NTIS HC A03/MF A01 CSCL 11H
The Lubricants Data Base System was designed and developed for operation on the DEC PDP 11/24 computer. The procedures are written in Datatrieve. In transferring the Lubricants System to the VAX 8600 computer, the Datatrieve had to be 80 percent rewritten. At the end of the contract the Lubricants System is operational on both the PDP 11/24 and VAX 8600 computers. The LOX/GOX, Aluminum/Steel, Toxic, VCM, and Flammability Systems are operational only on the PDP 11/24 computer. The Toxic, VCM, and Flammability Systems do not contain any useable data, only test data. However, the LOX/GOX file does contain test data results supplied by MSFC. B.G.

N88-15223*# Battelle Columbus Labs., Ohio.
EVALUATION OF LOAD TRACKS AND WEAR OF TWO SETS OF BEARINGS FROM SPACE SHUTTLE MAIN ENGINE HIGH PRESSURE OXYGEN TURBOPUMPS Final Report
J. W. Kannel and K. F. Dufrane 20 Nov. 1985 9 p
(Contract NAS8-36192)
(NASA-CR-178969; NAS 1.26:178969) Avail: NTIS HC A02/MF A01 CSCL 13K
Bearings supporting the rotor in the High Pressure Oxygen Turbopump (HPOTP) were examined. The No. 1 bearings from both units were in good condition and had successfully completed 5000 seconds of operation. The No. 2 bearings, which were in service the same length of time, were significantly degraded in the form of ball wear, race pitting, and damage from high axial loads. The No. 3 and 4 bearings were in generally acceptable condition. The general conclusion from the examinations was that improved cooling on the No. 2 bearings and further improvements in controlling axial and radial load would likely result in the HPOTP meeting the qualification test results. B.G.

N88-15224*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFICIENCY TESTING OF A HELICOPTER TRANSMISSION PLANETARY REDUCTION STAGE
Robert F. Handschuh and Douglas A. Rohn Feb. 1988 18 p Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(DA Proj. 1L1-61102-AH-45)
(NASA-TP-2795; E-3770; NAS 1.60:2795; AVSCOM-TR-87-C-28)
Avail: NTIS HC A03/MF A01 CSCL 13I
A parametric study of the efficiency of a 310-kW (420-hp) helicopter transmission planetary test section (four planets) was performed. The purpose was to determine the planetary contribution to the overall transmission power loss. Test parameters varied were oil flow rate, oil inlet temperature, lubricant type, shaft speed, and applied torque. The measured efficiency over all the test variables ranged from 99.44 to 99.75 percent. These experimental results were compared with other experimental and computational results. Author

N88-15225# National Bureau of Standards, Gaithersburg, Md. Metallurgy Div.
WELDABILITY OF A LEADED CARBON STEEL
J. G. Early and J. H. Smith Jun. 1987 20 p Sponsored by Coast Guard, Washington, D.C.
(PB88-110341; NBSIR-87/3598) Avail: NTIS HC A03/MF A01 CSCL 13H
Samples of A1S1 12L14, leaded free steel were welded using conventional metal-inert gas (MIG) welding procedures. The welds were evaluated for soundness and mechanical properties. Hardness, ductility, and microstructure were evaluated to assess the integrity of the welds. Sound welds were produced but the

overmatching strength of the weld metal resulted in failure in the Heat Affected Zone (HAZ). GRA

N88-15226# Lawrence Livermore National Lab., Calif.
COMPUTER SIMULATIONS OF BALLISTIC EXPERIMENTS
M. L. Wilkins and J. E. Reaugh 23 Jan. 1987 29 p Presented at the 3rd US Army Tank Automotive Command Armor Conference, Monterey, Calif., 17 Feb. 1987
(Contract W-7405-eng-48)
(DE87-005835; UCRL-95774; CONF-8702115-1) Avail: NTIS HC A03/MF A01

The efficiency of a projectile to penetrate a target depends on the projectile velocity and shape. The material properties of the target and projectile also have important roles. The projectile penetration process is studied in three phases: transient start-up, quasi steady-state and final. Computer simulations are presented that study the effects of the various parameters taken one at a time on the penetration of steel targets by tungsten alloy projectiles. The calculations are correlated with experimental data. DOE

N88-15227# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ELECTRONIC IMAGING TECHNIQUE FOR WELDING AND OTHER HIGH-LUMINOSITY PROCESSES
J. O. Bolstad Sep. 1987 24 p
(Contract DE-AC07-76ID-01570)
(DE88-002199; EGG-SD-7847) Avail: NTIS HC A03/MF A01

A new electronic imaging technique has been developed for use with electric arc welding and other high-luminosity processes. Intense light flashes are projected onto the welding site with a xenon flashlamp or pulsed laser. A conventional night-vision image-intensifier tube, used to view the welding site, is activated electronically only during the very brief duration of the light pulses. A small solid-state video camera captures the output image of the intensifier, and the light source is flashed at least once per video frame. The resulting video imagery is almost free of the welding arc light, and image quality is far superior to that obtained with ordinary video equipment. The technique has both experimental and industrial applications where there is need to see through intense arcs, plasmas, or flames, or to overcome the extreme spatial variation in brightness that is often characteristic of such processes. It can also be used to improve visibility of solid materials at high temperature, where surface detail is often masked by the self-luminosity of the material or by thermal equilibrium of the material with the walls of a furnace or kiln. DOE

N88-15228# Oak Ridge National Lab., Tenn.
A DEMONSTRATION OF AUTONOMOUS NAVIGATION AND MACHINE VISION USING THE HERMIES-2B ROBOT
B. L. Burks, D. L. Barnett, J. P. Jones, and S. M. Killough 1987 17 p Presented at the Southeastern Regional Media Leadership Council Conference on Microcomputers and Artificial Intelligence in Communication Technologies, Chattanooga, Tenn., 29 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE88-002298; CONF-8710195-1) Avail: NTIS HC A03/MF A01

Advances to the mobile robot series (HERMIES-2B) to include 8 NCUBE processors on-board, (computationally equivalent to 8 Vax 11/780's) operating in parallel, and augmentation of the sensor suite with cameras to facilitate on-board vision analysis and goal finding are described. The essential capabilities of the expert system described in earlier papers have been ported to the on-board HERMIES-2B computers thereby eliminating off-board computation. A successful experiment is described in which a robot is placed in an initial arbitrary location without prior specification of the room contents, successfully discovers and navigates around stationary and moving obstacles, picks up and moves small obstacles, searches for a control panel, and reads the meters found on the panel. DOE

N88-15229# Sandia National Labs., Albuquerque, N. Mex.
A RAPID POLISHING METHOD FOR KBr AND NaCl INFRARED WINDOWS
M. C. Oborny Sep. 1987 9 p
(Contract DE-AC04-76DP-00789)
(DE88-002480; SAND-87-0375) Avail: NTIS HC A02/MF A01

A method is described for polishing KBr and NaCl infrared windows which provides a considerable time savings compared to conventional polishing techniques using abrasive compounds. Window polished by this method has been found to be suitable for most applications in infrared spectroscopy. DOE

N88-15230# Fermi National Accelerator Lab., Batavia, Ill.
TESTS OF COLD HELIUM COMPRESSORS AT FERMILAB
T. J. Peterson and J. D. Fuerst Oct. 1987 9 p Presented at the Conference on Advances in Cryogenic Engineering, St. Charles, Ill., 14 Jun. 1987
(Contract DE-AC02-76CH-03000)
(DE88-002837; FNAL-TM-1485; CONF-8706125-19) Avail: NTIS HC A02/MF A01

Fermilab has tested two cold helium compressors for possible installation in the satellite refrigerator buildings of the Tevatron cryogenic system. Operating conditions required to obtain an overall Tevatron energy upgrade from 900 to 1000 GeV are (for each of 24 machines): 52 g/s mass flow rate, 0.7 atm inlet pressure, 1.4 atm exhaust pressure. Acceptable efficiency is in the 60 percent range. Both Creare, Inc., and Cryogenic Consultants, Inc. (CCI), have supplied units for evaluation. The Creare machine is a high speed centrifugal pump/compressor which yielded 60 percent adiabatic efficiency (including an approximately 20 watt heat leak) with a 1.0 atm inlet pressure and 55 g/s flow rate. Certain mechanical difficulties were present, chiefly the device's inability to withstand two-phase flow. CCI supplied a reciprocating unit which, after initial testing and modification, achieved 59 percent efficiency with an approximate 35 watt heat leak at a 0.7 atm inlet pressure and 48 g/s flow rate. Although the device lacks the smooth, quiet operating characteristics of a turbomachine, it has endured mechanically throughout testing and is entirely insensitive to two-phase flow. DOE

N88-15231*# Ohio State Univ., Columbus. ElectroScience Lab.
DESIGN AND IMPLEMENTATION OF THE ESL COMPACT RANGE UNDERHUNG BRIDGE CRANE
H. T. Shamansky, A. K. Dominek, and W. D. Burnside Sep. 1987 53 p
(Grant NsG-1613)
(NASA-CR-182396; NAS 1.26:182396; ELS-TR-716148-23)
Avail: NTIS HC A04/MF A01 CSCL 13I

As the indoor compact range technology has continued to increase, the need to handle larger and heavier targets has also increased. This need for target lifting and handling prompted the feasibility study of the use of an underhung bridge crane to be installed in the ESL (ElectroScience Laboratory, Ohio State University) compact range. This report documents both the design of the underhung bridge crane that was installed and the implementation of the design in the actual installation of the crane. Author

N88-15232# Harbin Inst. of Tech. (China).
WELDING IN HIGH PRESSURE CO2 ATMOSPHERE
T. Song and W. Huo 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144044; ISTIC-TR-C-000072) Avail: NTIS HC E03/MF E01 CSCL 13H

The main problems existing in hyperbaric CO2 welding were investigated. A new arc controlling method using an SCR power source with a dual-step output characteristic was proposed. The power source could provide higher voltage and energy to maintain a stable arc in welding with short circuiting transfer. When the pressure was higher than 5 bar, welding with straight polarity was recommended. The mechanical properties of the joint welded at a pressure of 8 bar remained good. The study laid a foundation for

the LD-CO2 underwater welding process to be applied at a greater depth of the air diving limit of 60 m or more. GRA

N88-15233# Tsinghua Univ., Beijing (China). Welding Div.
MICROCOMPUTER CONTROLLED ARC WELDING POWER SOURCE: ITS STEADY STATE AND TRANSIENT PERFORMANCE
Z. Wu, F. He, Z. Xu, C. He, and J. Pan 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143921; ISTIC-TR-C-000076) Avail: NTIS HC E03/MF E01 CSCL 13H

A closed-loop controlled arc welding power source using a microcomputer as controller is described. The system possess two advantages: (1) possibility of obtaining arbitrary type of output characteristics without changing hardware; (2) excellent transient performance. A nonlinear control mode applied in the system by software is developed for the purpose. The actual system is of a complicated discrete-smapling type, but for ease of studying and improving the performance of the system, a simplified mathematical model was set up through a synthetical study of the practical test results and theoretical analysis. Author

N88-15234# Tsinghua Univ., Beijing (China). Welding Div.
MIG WELDING WITH PULSED WIRE FEED
R. Zhang and P. Gao 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143582; ISTIC-TR-C-000075) Avail: NTIS HC E03/MF E01 CSCL 13H

The QH-ARC system, using the transistor power source with steplike output characteristics, provides a means for closed loop control of arc length during pulsed MIG welding. The pulse paramenters can be automatically optimized so as to maintain both constant arc length and spray metal transfer. Besides simplifying the adjustment of welding conditions of pulsed MIG process into one-knob control of wire feed speed, it led to the development of a new MIG technique with pulsed wire feed, which might be quite beneficial to positional welding, heat input control, bead formation control, and even the closed loop control of penetration. The technological features of MIG welding with pulsed wire feed and its preliminary experiments are described. Author

N88-15235# Tsinghua Univ., Beijing (China).
STUDY OF WELDING ARC CONTROL IN CHINA
J. L. Pan 1986 15 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143350; ISTIC-TR-C-000054) Avail: NTIS HC E03/MF E01 CSCL 13H

Arc behavior affects greatly the quality of the weld. Recent development of electronics offers powerful means and opens up broad prospects for controlling the arc behavior. The paper aims at introducing the status of the study of welding arc control in China. Achievements in the field of carbon dioxide welding, pulsed MIG welding, plasma arc welding, MIG welding of aluminum alloys and coated electrode manual arc welding are described. GRA

N88-15236# Jiaotong Univ., Shanghai (China).
PULSED PLASMA ARC WELDING PROCESS WITH DOUBLE CLOSED-LOOP ADAPTIVE PENETRATION CONTROL SYSTEM
D. He, S. Yao, C. Ni, and H. Yu 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143780; ISTIC-TR-C-000058) Avail: NTIS HC E03/MF E01 CSCL 13H

A pulsed plasma arc welding process (PPAW) with double closed-loop adaptive penetration control system is presented. The duration of pulse and background current are individually adjusted adaptively based on real-time penetration detected by two photocall sensors. Both the welding practice and the theoretical analysis indicate that the control system improves the adaptive control potential or the welding process substantially. Then the welding process is well protected against disturbances which would cause incomplete penetration or extra-protuberance of weld. As a result, the uniformity of weld penetration is secured. GRA

N88-15237# Harbin Inst. of Tech. (China). Welding Div.
STUDY ON AUTOMATIC DETECTION AND IDENTIFICATION OF DEFECTS IN WELD BY MICROCOMPUTER
L. Wu, D. Cheng, and Q. Xu 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143897; ISTIC-TR-C-000069) Avail: NTIS HC E03/MF E01 CSCL 13H

The paper describes the approaches of automatic detection and identification of welding defects by microcomputer. The image restoration, enhancement and binarization technique have been successfully used to reduce noises and to get more clear defect image. According to features of X-ray film, the two-branch tree and multisteps type recognition system has been developed. It can be used to detect and identify typical welding defects reliably. GRA

N88-15238# Harbin Inst. of Tech. (China). Welding Div.
STUDY ON ARC SOUND IN TIG AND PLASMA WELDING PROCESSES AND THE POSSIBILITY OF ITS APPLICATION IN PRACTICE
J. Zhang, Q. Wang, H. Cui, and S. Yin 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143947; ISTIC-TR-C-000078) Avail: Issuing Activity CSCL 13H

The method and device for detecting the welding arc sound signal under ambient noises are studied. Some relationships between arc sound and arc phenomena in TIG and plasma welding processes have been examined. Using the arc sound detected from the side of the welding torch the start and stop of welding carriage are controlled automatically according as the keyhole appears or disappears. The control method can be used to ensure the quality of the starting and ending welds automatically. It can be expected that the arc sound may be one of the prospective signals for controlling arc welding processes. GRA

N88-15239# Harbin Inst. of Tech. (China). Welding Div.
STUDY ON THE SQUARE WAVE ALTERNATING PLASMA ARC WELDING FOR ALUMINUM ALLOYS
S. Dong, S. Yang, T. Li, and Q. Wang 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143772; ISTIC-TR-C-000057) Avail: NTIS HC E03/MF E01 CSCL 13H

The possibility of the square wave alternating plasma arc welding for aluminum alloys is investigated and a comparison between the square wave alternating plasma arc welding and the sine wave alternating plasma arc welding is made. The influence of main parameters on width of bead and cathode cleaning zone, the parameter range for keyhole forming zone, and the tensile strength of weld are studied. Experiment indicates that, when the current in workpiece positive period equals 3 percent the cathode cleaning effect is good enough to obtain a sound weld. GRA

N88-15240# Northwestern Polytechnical Univ., Xian (China). Welding Div.
RESEARCH ON MICROPROCESSOR CONTROLLER FOR SPOT WELDING
K. Li, L. Wu, and Y. Zhao 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143913; ISTIC-TR-C-000071) Avail: NTIS HC E03/MF E01 CSCL 13H

During the process of spot welding the weld quality is usually unstable owing to the effects of various complex factors. With a wide application of microprocessors; research was conducted on a microprocessor controller used in the process of spot welding. The research demonstrates that: the SCR firing angle can be calculated with the given percent current (1 percent) and power factor angle line integral around a closed path in order to accomplish the automatic compensation of power factor and line voltage. The timing of weld schedules can be exactly guaranteed, cycle-by-cycle, by the programming of the microcomputer. The weld schedules of multiparameter and multiprogramming can be

carried out. There are adjustable up slope currents and down slope currents in the wleding sequences. The pressure of electrodes and working processes of SCR are monitored. Besides higher control accuracy, this design, as compared with others such as constant current method, needs no complex sensors and is available for more applications. GRA

N88-15241# Rockwell International Corp., Golden, Colo.
FARADAY CUP CHARACTERIZATION OF ELECTRON BEAM WELDING PARAMETERS
P. Burgardt, S. E. Knaus, and D. D. Kautz 12 Oct. 1987 16 p Presented at the International Conference on Applications of Electron and Laser Beam Welding, Hartford, Conn., 16 Sep. 1987 Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract DE-AC04-76DP-03533)
(DE88-001896; UCRL-97183; CONF-8709178-2) Avail: NTIS HC A03/MF A01

The use of the electron beam welding process to produce precision welds on many materials has been well documented in the literature. Some joint configurations may need more parameter control than is typically afforded by the standard electron beam welding machine. The repeatability and transferability of the electron beam welding parameters must also be regarded during weld development on many designs. Types of instrumentation which enhance the parameter control should be developed to higher levels. This instrumentation is important to the accurate transfer of technology between welding machines and production cycles. DOE

N88-15242# Department of Energy, Washington, D. C. Heat Engine Propulsion Div.
REPORT TO CONGRESS ON THE AUTOMOTIVE TECHNOLOGY DEVELOPMENT PROGRAM Annual Report No. 9
17 Sep. 1987 34 p
(DE88-003742; DOE/CE-0199) Avail: NTIS HC A03/MF A01

This report discusses DOE sponsored research in the area of automotive propulsion technology for the fiscal year 1987. Topics included are: (1) development of advanced heat engines with 30% improvement in fuel economy; (2) development of diesel engines with 30% improvement in fuel economy; (3) structural ceramics and advanced materials research; (4) establishment of a technology base for use of alternative fuels; (5) research and development of gas turbine, Stirling, and adiabatic diesel engines. DOE

N88-15243# Japan Atomic Energy Research Inst., Tokyo.
ANALYSIS OF THE MASS FORMULA DEPENDENCE OF SPALLATION PRODUCT DISTRIBUTION
Takahiko Nishida, Yasuaki Nakahara, and Tsuneo Tsutsui Jun. 1987 54 p
(DE88-750297; JAERI-M-87-088) Avail: NTIS (US Sales Only) HC A04/MF A01

A new version of a spallation reaction simulation code NUCLEUS has been developed by incorporating the newly revised Uno and Yamada's mass formula. The mass formula dependence of the spallation product distribution has been investigated by comparing the new results with those calculated by the original version which uses the combination of the Cameron's mass formula and the mass table compiled by Wapstra et al. Detailed differences between these two mass formulas are shown in the comparisons of mass excess values. The distributions of spallation products of a uranium target nucleus bombarded by high energy (0.38 - 2.9 GeV) protons have been calculated with the new and original versions of NUCLEUS. The calculated results show that there is no significant discrepancy in the non-fission component of cumulative product yields such as the mass distribution and the number of emitted neutrons but in the fission component Uno and Yamada's mass formula reproduces the measured data obtained from thin foil experiments significantly better, especially in the neutron excess side, than the Cameron's one. DOE

N88-15244# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
A NUMERICAL THERMAL MODEL OF THE RAPID SOLIDIFICATION PARAMETERS IN THE CAPACITOR DISCHARGE WELDING PROCESS
C. J. Einerson, D. E. Clark, and J. H. Devletian 1987 9 p Presented at the ASME/JSME/ISES Solar Energy Conference, Honolulu, Hawaii, 22 Mar. 1987 Prepared in cooperation with Oregon Graduate Center for Study and Research, Beaverton
(Contract DE-AC07-76ID-01570)
(DE88-002206; EGG-M-18186; CONF-870307-24) Avail: NTIS HC A02

The capacitor discharge (CD) welding process is investigated as a means of joining materials produced by Rapid Solidification Processing (RSP). The rapidly solidified microstructures produced by this process are evaluated and compared with the microstructure of the original RSP materials and a one-dimensional finite element heat conduction model is used to evaluate cooling rates, solidification rates, and temperature gradients near the fusion line. DOE

N88-15245# California Univ., Berkeley.
PIN JOINTS, GEARS, SPRINGS, CRANKS AND OTHER NOVEL MICROMECHANICAL STRUCTURES
Long-Sheng Fan, Yu-Chong Tai, and R. S. Muller Aug. 1987 5 p
(Contract W-7405-eng-48)
(DE88-002504; UCRL-15959) Avail: NTIS HC A02

The first fabrication of micrometer-scaled pin joints, gears, springs, cranks, and sliders made with silicon planar technology is presented. These micromechanical structures are batch-fabricated in an IC-compatible process using polysilicon deposited by chemical vapor deposition from silane and the sacrificial-layer technique. An important feature of this new technology makes use of the high surface mobility of polysilicon during CVD growth to refill undercut regions in order to form restraining flanges. The movable mechanical elements are built on layers that are later removed to free them so that translation and rotation can take place. Although this initial demonstration of the technique for making these structures has employed polysilicon as the structural material and phosphosilicate glass (PSG) for the sacrificial layer, other materials compatible with the IC process can be substituted as appropriate. DOE

N88-15246# California Univ., Los Angeles. Dept. of Materials Science and Engineering.
TRIBOLOGICAL STUDIES ON HIGH SPEED STEEL CUTTING TOOLS Final Report
P. Lin, C. Deshpandey, H. J. Doerr, and R. F. Bunshah Sep. 1987 11 p
(Contract DE-AC02-84CE-90227)
(DE88-002550; DOE/CE-90227/1) Avail: NTIS HC A03/MF A01

Carbide and nitride coatings of Ti, Zr and Hf were prepared using the Activated Reactive Evaporation process. The effect of deposition conditions on structure and properties of these coatings was evaluated. Optimum deposition conditions to obtain high values of microhardness in the coatings were established. High-speed steel cutting tools were coated under the respective optimum conditions and were tested for cutting performance. Results indicated that the coated inserts performed significantly better than uncoated inserts. ZrN coated inserts showed the best performance. Preliminary work was also carried out to synthesize (TiAl)N and (TiAl)C coatings. Coatings in the composition range (Ti/Al) between 80:20 to 30:70 were prepared. X-ray diffraction studies on the (TiAl)N coatings showed major peaks corresponding to TiN and very small peaks corresponding to AlN phase. Similarly (TiC) was found to be a major phase in (TiAl)C coatings. The microhardness of the coatings varied depending on their composition. Lower values observed for the microhardness of these coatings are believed to be due to the very small thickness of the coatings, (approx.1 micron)for a 50 gm load used in the hardness measurements. DOE

N88-15092# Yamagata Univ. (Japan). Dept. of Electrical Engineering.
EQUIVALENT CIRCUIT CONSIDERATION ON THE ROTATION OF RESONANT MODES OF DOUBLE RESONANT VIBRATORS
Konno Masashi, Yamayoshi Yasuhiro, Sugawara Sumio, and Tomikawa Yoshiro *In its* Bulletin of the Yamagata University (Engineering), Volume 20, No. 1, January 1988 Jan. 1988 p 1-11 In JAPANESE; ENGLISH summary (For primary document see N88-15091 07-31)
Avail: NTIS HC A07/MF A01

N88-15163# Concepts ETI, Inc., Norwich, Vt.
THE TECHNOLOGY OF CENTRIFUGAL COMPRESSORS: A DESIGN APPROACH AND NEW GOALS FOR RESEARCH
D. Japikse *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 70 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

N88-15165# Technische Univ., Hanover (West Germany). Inst. fuer Stroemungsmachinen.
BLADE VIBRATION PROBLEMS IN CENTRIFUGAL COMPRESSORS. FUNDAMENTAL CONSIDERATIONS
U. Haupt *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 26 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

N88-15166# Technische Univ., Hanover (West Germany). Inst. fuer Stroemungsmachinen.
BLADE VIBRATION DUE TO DIFFERENT FLOW EXCITATION
U. Haupt *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 47 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

N88-15167# Technische Univ., Hanover (West Germany). Inst. fuer Stroemungsmachinen.
BLADE EXCITATION DUE TO UNSTEADY FLOW PHENOMENA
U. Haupt *In* Von Karman Inst. for Fluid Dynamics, Flow in Centrifugal Compressors 1987 35 p (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

N88-15170# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
NUMERICAL STUDY OF A CENTRIFUGAL IMPELLER RESPONSE TO A DOWNSTREAM STATIC PRESSURE PERTURBATION
Mario Th. Sideris *In its* Flow in Centrifugal Compressors (date) 39 p(SEE N88-15160 07-34) 1987 (For primary document see N88-15160 07-34)
Avail: NTIS HC A25/MF A01

N88-15623*# Tennessee Univ., Chattanooga. Dept. of Mechanical Engineering and Mechanics.
THE DETERMINATION OF EQUIVALENT BEARING LOADING FOR THE BSMT THAT SIMULATE SSME HIGH PRESSURE OXIDIZER TURBOPUMP CONDITIONS USING THE SHABERTH/SINDA COMPUTER PROGRAMS
Gary H. McDonald *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 23 p (For primary document see Summer Faculty Fellowship Program 23 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 13I

N88-15634*# California Polytechnic State Univ., San Luis Obispo. Dept. of Metallurgy and Materials Engineering.
EXAMINATION OF THE PHYSICAL PROCESSES ASSOCIATED WITH THE KEYHOLE REGION OF VARIABLE POLARITY PLASMA ARC WELDS IN ALUMINUM ALLOY 2219
Daniel W. Walsh *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 26 p (For primary document see Summer Faculty Fellowship Program 26 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N88-15247# Connecticut Univ., Storrs.
ROBUST PREDICTION AND INTERPOLATION FOR VECTOR STATIONARY PROCESSES, 2D ENRICHED VERSION Final Report, 1 Jul. 1983 - 30 Jun. 1987
P. Papantoni-Kazakos May 1987 6 p
(Grant AF-AFOSR-0229-83)
(AD-A185875; AFOSR-87-1234TR) Avail: NTIS HC A02/MF A01 CSCL 09D

The main objectives of this research have been the development of smooth nonparametric estimators of quantile functions from right-censored data and the further study of smooth density estimators from censored observations. In particular, kernel type and generalized quantile estimators have been obtained under censoring which give better estimates of percentiles of the lifetime distribution than the usual product-limit quantile estimator. Other new results include the study of linear empirical Bayes estimators, prediction intervals for the inverse Gaussian distribution, nonparametric hazard rate estimation under censoring, nonparametric inference for step-stress accelerated life tests under censoring. Discrete failure models, reliability estimation when cause of failure is partially known, Gompertzian failure models, simultaneous confidence intervals for pairwise differences of normal means, and optimal designs for comparing treatments with a control. GRA

N88-15248# North Carolina Univ., Chapel Hill. Operations Research and Systems Analysis.
ESTIMATING SYSTEM RELIABILITY: MONTE CARLO METHODS, SENSITIVITY AND ERRORS IN INPUT PARAMETERS
George S. Fishman Jan. 1987 23 p
(Grant AF-AFOSR-0140-84)
(AD-A186182; UNC/ORSA/TR-87/1; AFOSR-87-1092TR) Avail: NTIS HC A03/MF A01 CSCL 14D

The computation of system reliability from component reliabilities presents a host of non-trivial problems for systems of varying sizes. These include the functional relationship between the time required to compute system reliability and system size. A second problem concerns how system reliability varies as component reliabilities vary. A third problem concerns how statistical errors in estimating component reliabilities affect the accuracy of the system reliability computation. This paper describes Monte Carlo techniques which provide useful answers to the first two problems and presents an analysis which establishes the potential seriousness of the third problem in practice. GRA

N88-15249# North Carolina Univ., Chapel Hill. Operations Research and Systems Analysis.
HOW ERRORS IN COMPONENT RELIABILITY AFFECT SYSTEM RELIABILITY
George S. Fishman Jul. 1987 31 p
(Grant AF-AFOSR-0140-84)
(AD-A186264; UNC/ORSA/TR-87/3; AFOSR-87-0994TR) Avail: NTIS HC A03/MF A01 CSCL 14D

This paper studies how sampling variation in component reliability estimates affects the computation of system reliability that uses these estimates as input. Results show that relative bias in system reliability grows quadratically with the number of components for which each component reliability estimate is used whereas the corresponding coefficient of variation grows linearly with this number of components. If these components are in parallel

they lead to an understatement of system reliability. In series, they lead to an overstatement. The paper describes resampling schemes that eliminate bias without increasing the dominant variance term. GRA

N88-15250# Naval Postgraduate School, Monterey, Calif.
FAULT TREE RELIABILITY ANALYSIS OF THE NAVAL POSTGRADUATE SCHOOL MINI-SATELLITE (ORION) M.S. Thesis
Trenton G. Keeble Sep. 1987 82 p
(AD-A186283) Avail: NTIS HC A05/MF A01 CSCL 14D

Fault tree analysis, which has proved to be a useful analytical tool for the reliability and safety analysis of complex systems, is applied to the Naval Postgraduate School Mini-Satellite (ORION). A general background to reliability analysis, fault tree analysis, and fault tree construction is given. Impact of a phased mission is included in the analysis. A fault tree for ORION is constructed and used to indentify minimal cut sets and minimal path sets. The cuts sets and path sets are, in turn, used to calculate an estimate of ORION's reliability to perform a three year mission. The reliability model was constructed in a Lotus 1-2-3 spreadsheet to enable the designers to do what-if analysis. Author (GRA)

N88-15251# Stanford Univ., Calif. Center for Reliable Computing.
INADEQUACY OF CONVENTIONAL DYNAMIC RECOVERY MECHANISMS IN THE PRESENCE OF TEMPORARY FAILURES
Hassanein H. Amer, Mario L. Cortes, and Edward J. McCluskey Jun. 1987 30 p
(Contract N00014-85-K-0600)
(AD-A186311; CRC-TR-87-11) Avail: NTIS HC A03/MF A01 CSCL 14D

This paper shows that some implementations of fault-tolerant systems with dynamic error detection and reconfiguration mechanisms may not recover from certain types of temporary failures. An experiment is conducted to study the effect of temporary failures on the behavior of a dynamically redundant fault-tolerant system. The system is built out of LSTTL catalog parts. Transient failures are induced by reducing the power supply voltage; intermittent failures are induced loading nodes in the system. Reducing the power supply voltage produces common-mode failures that can be detected if the recovery mechanism produces high amplitude oscillations when its inputs are near the threshold level. Intermittent failures can be detected if the recovery mechanism detects errors before incorrect data is transmitted through the output devices. It is shown that the stuck-at fault model is inappropriate for the temporary failures injected into the system. Techniques are suggested that will guarantee detection of many transient and intermittent failures. GRA

N88-15252# Naval Postgraduate School, Monterey, Calif.
DISCRETE RELIABILITY GROWTH MODELS USING FAILURE DISCOUNTING M.S. Thesis
James E. Drake Sep. 1987 128 p
(AD-A186380) Avail: NTIS HC A07/MF A01 CSCL 14D

Three discrete reliability growth models using fractional failure reduction, referred to as failure discounting, were developed to estimate changing system reliability. Each of the models is designed for use when testing is performed until a fixed number of failures have been observed and attribute data, success or failure, is available for each trial. The first reliability growth model applies failure discounting to the maximum likelihood estimate for a proportion. The second and third models use a modification of an exponential reliability estimate employing linear regression and a weighted average technique respectively along with failure discounting to track changing reliability. Two failure discounting methods were used with each reliability growth model. The first method reduces past failures by a fixed fraction at a fixed interval. The second method uses the upper confidence bound for the reoccurrence of each failure cause as the discounted failure value. The performance of the reliability growth models with varying reliability growth patterns was evaluated with a Monte-Carlo computerized simulation. GRA

N88-15253# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
CONTROL CHARTS WHEN THE OBSERVATIONS ARE CORRELATED
P. R. Krishnaiah and B. Q. Miao May 1987 14 p
(Contract F49620-85-C-0008)
(AD-A186388; TR-87-09; AFOSR-87-1109TR) Avail: NTIS HC A03/MF A01 CSCL 14D

Traditionally, quality control charts have been designed with respect to statistical criteria only, and the control methodology is based on the independence and normality of serial samples. At first the production process is assumed to be characterized by a single in-control state. For example, if the process has one measurable quality characteristic, then the in-control state will correspond to the mean of this quality characteristic when no assignable cause is present. GRA

N88-15254# National Bureau of Standards, Gaithersburg, Md. Inst. for Computer Sciences and Technology.
ANNOTATED BIBLIOGRAPHY ON RELIABLE SYSTEM DESIGN
W. McCoy, K. Roessing, and M. Ruhl May 1987 116 p
(PB88-109848; NBSIR-87/3559) Avail: NTIS HC A06/MF A01 CSCL 14D

The difficulty is assuring some level of fault tolerance, reliability, safety availability,or survivability in a large, complex distributed system was long recognized. Techniques are now emerging that try to address the issue in system design, including a formal description, design tools, automatic implementation, and system simulation. The bibliography contains brief summaries of 350 papers from various computer science and engineering journals, books, dissertations, and technical reports in the years 1972-1987, on these and related topics. GRA

N88-15255# Oak Ridge Y-12 Plant, Tenn.
A PULSED EDDY CURRENT METHOD FOR EXAMINING THIN-WALLED STAINLESS STEEL TUBING
C. A. Pickett, D. W. Koerner, C. V. Dodd, and W. E. Deeds 31 Jul. 1987 13 p Presented at the Review of Progress in Quantitative NDE, Williamsburg, Va., 21 Jun. 1987
(Contract DE-AC05-84OS-21400)
(DE88-002294; Y/DW-721; CONF-870691-6) Avail: NTIS HC A03/MF A01

A bellows was fabricated from a 12-in. section of type 321 or type 316 stainless steel tubing. In order to ensure that the bellows would survive the rigors of the production environment, it was essential that the tubing be free of all scratch like defects. A feasibility study was conducted to determine if an eddy current method could be developed to nondestructively examine this tubing. The problem consisted of inspecting large quantities of the thin-walled stainless steel tubing to a sensitivity level of 0.0006 in. (0.015 mm). The defects could be located on either the interior or exterior surface of the tube. The tubes were nominally 0.144 in. (3.66 mm) in diameter and approximately 0.005 in. (0.127 mm) thick. The individual length of each tube ranged anywhere from 20 to 40 in. (0.6 to 1.0 m). This report describes the feasibility testing that was conducted, along with the design and development of a pulsed eddy current instrument. The inspection capability of this instrument is also detailed. DOE

N88-15256# Universite de Technologie de Compiegne (France).
IMPROVEMENT OF DEEP RESOLUTION IN ULTRASONIC ECHOGRAPHIC NONDESTRUCTIVE EVALUATION USING SIGNAL PROCESSING METHODS Final Report [AMELLORATION DE LA RESOLUTION EN PROFONDEUR DU CONTROLE NON DESTRUCTIF PAR ECHOGRAPHIE ULTRASONORE AU MOYEN DE METHODES DE TRAITEMENT DU SIGNAL]
J. F. deBelleval, C. Chassaignon, and P. Gaillard Apr. 1986 106 p In FRENCH; ENGLISH summary Sponsored by Direction des Recherches, Etudes et Techniques, Paris (France).
(PB87-147658; UTC-86/11) Avail: Issuing Activity CSCL 14D

Two methods for improving deep resolution in nondestructive evaluation using ultrasonic echography are suggested and

evaluated. The first is based on processing of the reception signal, the second on optimization of the stimulus signal of the ultrasonic transducer. These methods resulted in a 3 to 4 factor increase in resolution and did not seem affected by the surface roughness of the part being inspected. GRA

N88-15257*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMAGING SUBTLE MICROSTRUCTURAL VARIATIONS IN CERAMICS WITH PRECISION ULTRASONIC VELOCITY AND ATTENUATION MEASUREMENTS
Edward R. Generazio, Don J. Roth, and George Y. Baaklini Nov. 1987 11 p Presented at the Review of Progress in Quantitative NDE, Williamsburg, Va., 21-26 Jun. 1987; sponsored by Iowa State Univ.
(NASA-TM-100129; E-3710; NAS 1.15:100129) Avail: NTIS HC A03/MF A01 CSCL 14D

Acoustic images of a silicon carbide ceramic disk were obtained using a precision scanning contact pulse echo technique. Phase and cross-correlation velocity, and attenuation maps were used to form color images of microstructural variations. These acoustic images reveal microstructural variations not observable with X-ray radiography. Author

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N88-15258# Washington Univ., Seattle. Dept. of Mechanical Engineering.
J-ESTIMATION PROCEDURE BASED ON MOIRE INTERFEROMETRY DATA
B. S. Kang and A. S. Kobayashi Aug. 1987 30 p
(Contract N00014-85-K-0187)
(AD-A185965; AD-F000114; UWA/DME/TR-87/58; UWA/DME/TR-85/51) Avail: NTIS HC A03/MF A01 CSCL 20K

The J-integral, which has been heralded by many as a stable crack growth and ductile fracture criteria and which in its linearly elastic limit becomes the strain energy release rate, derives its popularity in being a path-independent integral. The purpose of this paper is to review an experimental procedure, which was developed by the authors, using Moire interferometry, for estimating the J-integral values along contours inside fracture specimens and to present some resistance curves, R-curves, of aluminum single edge notched (SEN) specimens. GRA

N88-15259# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL INVESTIGATION OF DAMPING CHARACTERISTICS OF BOLTED STRUCTURAL CONNECTIONS FOR PLATES AND SHELLS M.S. Thesis
Jonathan C. Iverson Sep. 1987 83 p
(AD-A186075) Avail: NTIS HC A05/MF A01 CSCL 13E

Reducing the contact force in bolted structural connections can reduce system vibration amplitudes by enhancing joint damping capacity. A test model consisting of two concentric circular cylindrical shells and four vanes connected by groups of bolts was tested and analyzed to investigate the relationship between the contact force and the system damping. A viscoelastic material was then introduced between the contacting surfaces and its effects on system damping were again investigated. Experimental results show that resonant frequencies of modes whose mode shapes provided the most differential motion at the joint connection were shifted down in frequency and the damping increased. This damping increase and frequency shift continued as contact force was reduced until the structural joints moved into the total slip regime where the response becomes nonlinear. GRA

N88-15260# Naval Postgraduate School, Monterey, Calif.
DATA ACQUISITION, REDUCTION AND ANALYSIS OF SHOCK AND VIBRATION TESTING USING A SUPER MICROCOMPUTER M.S. Thesis
Robert A. Shafer Jun. 1987 91 p
(AD-A186123) Avail: NTIS HC A05/MF A01 CSCL 20K

Data acquisition modules allow the addition of powerful components to a microcomputer. Modules consisting of the necessary Analog to Digital converters, Digital to Analog converters, and the hardware necessary to support sixteen channels of input data can easily fit inside desk top microcomputers. Fast 32 bit processors, small high volume hard disk drives and large RAM capacities complete the package, enabling a microcomputer to perform complex dynamic signal analysis. One application of the super microcomputer is in the field of underwater explosion shock testing. The combination of the acquisition and analysis capabilities in the same device eliminates the requirement to record the data to an intermediate device prior to analysis. Thus the data can be analyzed within minutes of the completion of the experiment, giving immediate results at the testing site instead of an analysis facility. Another application of the data acquisition equipped microcomputer is in the analysis of the frequency response characteristics of structures. Programming the microcomputer to acquire the data from a vibrating structure in order to determine the dynamic signature is easily done. Discussed in this study is the method utilized to validate a data acquisition equipped microcomputer for such applications. GRA

N88-15261# Maryland Univ., College Park. Inst. for Physical Science and Technology.
THEORETICAL INVESTIGATIONS OF CHAOTIC DYNAMICS Final Report, 15 Jun. 1981 - 29 Nov. 1986
James A. Yorke 25 Jan. 1987 4 p
(Grant AF-AFOSR-0217-81)
(AD-A186404; AFOSR-87-1272TR) Avail: NTIS HC A02/MF A01 CSCL 12A

Problems arising in the area of nonlinear vibrations were studied. Essentially equations such as that for a periodically forced, damped pendulum are capable of exhibiting behavior which was unsuspected even 10 years ago and the principal investigator was in the forefront to the effort to explain these mysteries. It was he who coined the term chaos and the students and publications here identified are confined to that topic. Dr. Yorke reports on work to determine the factual dimension of attracting sets for differential equations together with some vigorous results on the dependence of such sets on equation parameters. GRA

N88-15262# Naval Research Lab., Washington, D.C.
A CRITICAL REVIEW OF THE DEVELOPMENT OF SEVERAL VISCOPLASTIC CONSTITUTIVE THEORIES
John Eftis and Mitchell I. Jolles 15 Sep. 1987 80 p Prepared in cooperation with Geo-Centers, Inc., Suitland, Md.
(AD-A185652; NRL-MR-5942) Avail: NTIS HC A05/MF A01 CSCL 20K

The need to model the rate dependence that is inherent in non-recoverable deformation of structural materials and the continued progress in computational capability have served as stimuli for the rapid development of viscoplastic constitutive theory. The structure and development of these theories can be separated into two categories: those with or without yield condition. All theories reviewed here have common underlying features and limitations: phenomenological, homogeneous material continuum, nonrecoverable deformation is a constant volume process, deformation may be decomposed into linearly additive elastic and inelastic parts. Comparisons are made among predictions of a modified Chaboche and Bodner theories, and experiments of Inconel at 1200 F for various loading conditions. GRA

N88-15263*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE PREDICTION OF THERMOMECHANICAL FATIGUE USING TOTAL STRAIN VERSION OF STRAINRANGE PARTITIONING (SRP): A PROPOSAL

James F. Saltsman and Gary R. Halford Feb. 1988 25 p
(NASA-TP-2779; E-3795; NAS 1.60:2779) Avail: NTIS HC A03/MF A01 CSCL 20K

A method is proposed (without experimental verification) for extending the total strain version of Strainrange Partitioning (TS-SRP) to predict the lives of thermomechanical fatigue (TMF) cycles. The principal feature of TS SRP is the determination of the time-temperature-waveshape dependent elastic strainrange versus life lines that are added subsequently to the classical inelastic strainrange versus life lines to form the total strainrange versus life relations. The procedure is based on a derived relation between failure and flow behavior. Failure behavior is represented by conventional SRP inelastic strainrange versus cyclic life relations, while flow behavior is captured in terms of the cyclic stress-strain response characteristics. Stress-strain response is calculated from simple equations developed from approximations to more complex cyclic constitutive models. For applications to TMF life prediction, a new testing technique, bithermal cycling, is proposed as a means for generating the inelastic strainrange versus life relations. Flow relations for use in predicting TMF lives would normally be obtained from approximations to complex thermomechanical constitutive models. Bithermal flow testing is also proposed as an alternative to thermomechanical flow testing at low strainranges where the hysteresis loop is difficult to analyze. Author

N88-15264# Sandia National Labs., Albuquerque, N. Mex.
STRUCTURAL RELAXATION IN STRAINED-LAYER HETERO-STRUCTURES
B. W. Dodson and J. Y. Tsao 1987 12 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002326; SAND-87-2328C; CONF-871027-39) Avail: NTIS HC A03/MF A01

The relaxation of misfit strain in metastable structures by plastic flow is described using a continuum model based on Haasen's picture of plastic flow in bulk diamond-phase semiconductors. This model provides an explanation of the relaxation behavior of metastable strained-layer structures, as well as the metastable critical thicknesses reported in many semiconductor strained-layer experiments. Also introduced are a compact means of summarizing the stability behavior of such structures by introducing an analog to the deformation-mechanism maps of Ashby and Frost, which have provided an elegant means of describing plastic deformation in bulk materials. DOE

N88-15265# Lehigh Univ., Bethlehem, Pa. Engineering Lab.
DEFORMATION INDUCED CRACKING IN STEEL GIRDER BRIDGES AND RETROFIT GUIDELINES Final Report, Aug. 1984 - Nov. 1986
J. W. Fisher, E. J. Kaufmann, C. N. Kostem, J. J. Lee, and B. T. Yen Jul. 1987 180 p Sponsored in part by Pennsylvania Dept. of Transportation, Harrisburg
(PB88-102710; FRITZ-ENG-LAB-500-3(87); FHWA/PA-86/030/83-21) Avail: NTIS HC A09/MF A01 CSCL 20K

Cracks have been found in the webs of steel girder bridges at details with small web gaps subjected to out of plane deformation. Both multigirder and floor beam girder bridges were studied. Included were field inspections, field measurements of stresses, laboratory examination of core samples, and analytical modeling. The stresses due to out of plane displacement are highly localized in the vicinity of the web gap regions. Finite element models showed good agreement between computed and measured stresses in the gap regions. Parametric studies were also carried out to examine the major factors which cause adverse stress distributions in these gap regions. Stress redistribution after development of through thickness cracks were examined analytically. Retrofit schemes and guidelines for design were developed. Author

N88-15266# Harbin Inst. of Tech. (China).
ANALYSIS OF STABLE CRACK GROWTH WITH ISOTROPIC AND KINEMATIC HARDENING
S. Du 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144911; ISTIC-TR-C-000036) Avail: NTIS HC E03/MF E01 CSCL 20K

Stable crack growth has been analyzed with a finite element method based on an incremental theory of isotropic and kinematic hardening. The stress field near the crack tip and the plastic energy during the crack growth process have been obtained. The models of isotropic and kinematic hardening were compared. Also, crack growth of a combined-mode crack in plane stress has been determined. GRA

N88-15267# Harbin Inst. of Tech. (China). Welding Div.
STUDY ON FRACTURE BEHAVIOUR OF A JOINT WITH A CRACK IN TRANSVERSE HARD LAYER: EFFECT OF HARD LAYER WIDTH ON COD
X. Tian, H. Zhu, and W. Ma 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143855; ISTIC-TR-C-000065) Avail: NTIS HC E03/MF E01 CSCL 20K

A simplified model of a welded joint with a cold crack in hardened HAZ adjacent to softer weld and base metal has been used as a first approximation. The model is composed of two homogeneous soft strips and an intermediate homogeneous hard layer with a central crack. Stress and strain field and chemical oxygen demand (COD) in the region surrounding the crack tip in specimens with a hard layer of various widths have been analyzed by mechanical (moire method) interferometry and by finite element method as well. The results obtained show that when the load is sufficiently high, the narrower the hard layer, the larger the plastic zone in the softer adjacent metal and the larger the COD. GRA

N88-15268# Academia Sinica, Beijing (China). Inst. of Mechanics.
HYBRID FEM (FINITE ELEMENT METHOD) APPROACH TO STRESS DISTRIBUTION IN THE VICINITY OF A NOTCH IN NON-HOMOGENEOUS MATERIALS
S. Zhang 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143392; ISTIC-TR-C-000003) Avail: NTIS HC E03/MF E01 CSCL 20K

An approach to the stress distribution in the vicinity of a notch root of an unidirectional carbon fiber reinforced epoxy specimen is presented. The hybrid finite element method was adopted to solve the problem. A brief derivation of the element stiffness matrix of hybrid FEM was given. The effects of the orthotropy and heterogeneity of the material on the stress distribution were considered owing to their important role on the fracture behavior of these kinds of materials. It is shown that the stress concentration factor calculated with the existing homogeneous material model underestimates the possibility of shear splitting failure of the concerned material. Author

N88-15269# Beijing Aeronautical Mfg. Technology Research Inst. (China). Welding Lab.
TRANSIENT WELDING STRAIN MEASUREMENT BY MOIRE TECHNIQUE: A COMPARISON BETWEEN EXPERIMENTAL MEASUREMENT AND NUMERICAL ANALYSIS FOR STRAIN-STRESS CYCLES DURING GTA SPOT-WELDING
Q. Guan, J. Liu, Y. Fu, Y. Shao, and B. Jin 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143871; ISTIC-TR-C-000067) Avail: NTIS HC E03/MF E01 CSCL 20K

A series of specific techniques related to the application of a high temperature Moire method for measurement of transient welding strains were developed. Descriptions of procedures such as the preparation of a heat-resistant reflective grid on a metallic specimen, the recording of transient strain information and data processing of Moire fringe patterns are given. By the use of

developed techniques the transient strain cycles during GTA spot welding on thin plates were measured. Experimental measurement results were compared with numerical analysis and then discussed. GRA

N88-15270# Beijing Univ. (China). Dept. of Materials.
STUDY ON CHARACTERISTICS OF SCC PROPAGATION da/dt FOR WELDED JOINT
J. Song, Z. Wang, and X. Chang 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143640; ISTIC-TR-C-000052) Avail: NTIS HC E03/MF E01 CSCL 13I

Characteristics of transverse propagation (TP) and longitudinal propagation (LP) of stress corrosion cracking on parent metals, welded metals, and heat affected zone of steels of 16Mn, 09MnTiCuRe I and II, using constant displacement WOL specimen were demonstrated. Micro and macro fractographs were carefully observed and analyzed. Two kinds of heat simulated specimens of fusion line were used, and it is proved that the stress corrosion resistance of the fusion line is the lowest. The front of longitudinally propagated crack at the fusion line presented a concave shape and the curve da/dt-K sub 1 of TP appeared in saddle pattern. Author

N88-15271# Beijing Inst. of Aeronautics and Astronautics (China).
SHEAR FAILURE IN ROUND BAR TENSILE TESTS OF Al-Zn-Mg-Cu ALLOYS
C. Chen 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143632; ISTIC-TR-C-000051) Avail: NTIS HC E03/MF E01 CSCL 20K

Round bar tensile tests of two Al-Zn-Mg-Cu alloys (7010 and 7475) were carried out. The underaged and peak aged specimens of both alloys exhibit shear failure, whereas the overaged specimens of both alloys exhibit conventional cupcone modes of failure. Presumably it is due to their different critical values of the ratio of slip plane hardening rate to the tensile stress at that instant for shear localization. Both the underaged and peak aged specimens have higher critical ratios for shear localization than that of the overaged specimens, so it is easier to attain such localization during the test. The shear failure follows immediately after the shear localization. Author

N88-15272# Instituut TNO voor Bouwmaterialen en Bouwconstructies, Delft (Netherlands).
BEHAVIOR OF A STEEL CYLINDER UNDER THE INFLUENCE OF A LOCAL LOAD IN THE ELASTIC AND ELASTO-PLASTIC AREA
J. Spiekhout, A. M. Gresnigt, and G. M. A. Kusters 1986 10 p
(PB87-154787) Avail: NTIS HC E03/MF E01 CSCL 20K

The resistance of pipelines against mechanical damage was studied. The cause of mechanical damage was assumed to be a hydraulic excavator. A calculation model for the relation between local and indentation depth, including internal pressure is given. The formulas were derived by means of theory of shells and theory of plasticity. Via coefficients and a few interventions, these theoretical formulas were adapted to the results of tests and the results of finite element calculations. The calculation model thus obtained is capable of predicting the real local load indentation depth diagram in a sufficiently accurate manner. The finite element method calculations were carried out with the DIANA program of IBBC-TNO. In these computer calculations elasto-plastic material behavior, large displacement options and nonconservative gas pressure were included. Author

N88-15273# Xian Jiaotong Univ. (China). Inst. for Strength of Metals.
PROPAGATION OF FATIGUE CRACK IN THE MEDIUM-CARBON STEEL CONTAIING BOTH MARTENSITE AND FERRITE
Y. Song, J. Liu, L. Shen, Q. Rao, and H. Zhou 1986 9 p Sponsored by Inst. of Scientific Technical Information of China, Beijing
(PB87-143962; ISTIC-TR-C-000080) Avail: Issuing Activity CSCL 20K

The process is investigated of initiation and propagation of microcracks in 45 Cr and 60 D steels with duplex microstructure of martensite and ferrite, on the basis of experiments, the mechanism of fatigue crack propagation delayed by undissolved ferrite is proposed. The experimental results show that a proper amount of massive or fine granular undissolved ferrite in martensite can increase fatigue resistance remarkably under higher cyclic loading without losing the extra high strength and endurance limit of rotating beam fatigue of the materials. The duplex microstructure of martensite and ferrite exhibits longer N sub O, K sub IC, lower rate of crack propagation, higher threshold level delta K sub th and better fracture toughness K sub IC as compared to the microstructure of single tempered martensite for the materials under consideration. Author

N88-15274# Chinese Academy of Building Research, Beijing.
BENDING ANALYSIS OF THIN PLATES WITH OPENINGS
W. Zhang and X. Wu 1986 7 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143400; ISTIC-TR-C-000004) Avail: NTIS HC E03/MF E01 CSCL 20K

A semi-analytical and semi-discretizing method is presented for the bending analysis of thin plates with openings. The plate is divided into a number of subplates and each subplate is treated as a single-connected plate with no opening. First, an analytical solution satisfying the fundamental differential equation within the subplate is given, than an appropriate amount of discrete points at the boundary of plate and at the interfaces between subplates are chosen, so that the relevant boundary and interface conditions are to be satisfied at these points. In such a way, the solution of the plate with openings can be obtained. Two numerical examples of the bending analysis of plates with openings are given. GRA

N88-15275# Metz Univ. (France). Faculte des Sciences.
STATIC AND DYNAMIC DETERMINATION OF ALUMINUM OXIDE TOUGHNESS [DETERMINATION DE LA TENACITE DUNE ALUMINE EN STATIQUE ET EN DYNAMIQUE]
G. Pluvinage May 1986 51 p In FRENCH; ENGLISH summary Sponsored by Direction des Recherches, Etudes et Techniques, Paris (France)
(PB87-146999) Avail: Issuing Activity CSCL 20K

A method was proposed for determining dynamic toughness using a Hopkinson rod device and WLCT test pieces. A three parameter description was given of dynamic tenacity using a Weibull fracture probability function distribution model. And the static and dynamic toughness were compared of two aluminum oxide samples from two different manufacturers. It was possible to determine the fracture resistance of a ceramic subjected to dynamic stress using a Hopkinson-WLCT method and a three parameter method of evaluation. It was not possible, due to the limited nature of the study, to investigate the evolution of the threshold stress intensity factor as a function of the wave indentation length or to link the quantitative data on the nature of activated defects to the Weibull module using a local probabilistic approach. Author

N88-15276# Oak Ridge National Lab., Tenn.
DISLOCATION FREE ZONE MODEL OF FRACTURE UNDER REVERSE LOADING
S. J. Chang and S. M. Ohr 1987 23 p Presented at the Colloquia on Modern Topics in Mechanics, Evanston, Ill., 4 Dec. 1987 Prepared in cooperation with State Univ. of New York, Stony Brook
(Contract DE-AC05-84OR-21400)
(DE88-002676; CONF-871235-1) Avail: NTIS HC A03/MF A01

We examined the effect of reverse loading and anti-shielding on the local stress intensity, and size of DFZ and the associated distribution functions of dislocations. It was shown in the numerical results that during reverse loading two distinct equilibrium distributions of dislocations are possible solutions to the pileup integral equation but these distributions result in different local stress intensity factors. The true distribution can be selected from

the two if the local stress intensity factor is limited by the reversed critical stress intensity factor for dislocation emission -K(sub g). The negative dislocations generated during reverse loading or cyclic loading lead to crack growth. DOE

N88-15277# Lawrence Livermore National Lab., Calif.
MODAL ANALYSES OF THE KERNVILLE DIAGNOSTIC CANISTER
B. L. Stavnheim Nov. 1987 29 p
(Contract W-7405-eng-48)
(DE88-003268; UCID-21240) Avail: NTIS HC A03/MF A01

Multiple modal analyses were recently performed on the Kernville diagnostic canister. Vibration data were recorded using TEAC 21-channel data recorder and subsequently analyzed at Livermore using a new computer code PROCESS resulting in a significant improvement over prior methods of dynamic testing. To better evaluate the quality of results obtained from a dynamic analysis a repeatability test was performed. Test results demonstrated the ability to reproduce resonance frequencies to within 0.4 percent. It likewise emphasized the difficulty of evaluating resonance damping coefficients for lightly damped structures in the presence of noise. DOE

N88-15093# Yamagata Univ. (Japan). Dept. of Electrical Engineering.
ANALYSES BY EQUIVALENT MECHANICAL CIRCUITS OF BENDING VIBRATION BARS WITH LOAD-IMPEDANCE AT ONE END
Konno Masashi, Yamayoshi Yasuhiro, Nakamura Hisashi, and Oyama Shigeru *In its* Bulletin of the Yamagata University (Engineering), Volume 20, No. 1, January 1988 Jan. 1988 p 13-26 In JAPANESE; ENGLISH summary (For primary document see N88-15091 07-31)
Avail: NTIS HC A07/MF A01

N88-15613*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Mechanical Engineering.
VERIFICATION OF FANTASTIC INTEGRATED CODE
Rajinder Singh Chauhan *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 13 p (For primary document see Summer Faculty Fellowship Program 13 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20K

N88-15629*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
AN INVESTIGATION OF OBLIQUE HYPERVELOCITY IMPACT
William P. Schonberg *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 30 p (For primary document see Summer Faculty Fellowship Program 30 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20K

N88-15630*# Arkansas Univ., Little Rock. Dept. of Mechanical Engineering.
EVALUATE THE APPLICATION OF MODAL TEST AND ANALYSIS PROCESSES TO STRUCTURAL FAULT DETECTION IN MSFC - STS PROJECT ELEMENTS
William T. Springer *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 25 p (For primary document see Summer Faculty Fellowship Program 25 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N88-15278# Naval Postgraduate School, Monterey, Calif.
MODEL-BASED BUILDING VERIFICATION IN AERIAL PHOTOGRAPHS Annual Report, Oct. 1985 - Sep. 1986
Chin-Hwa Lee and Hsi-Jian Lee Sep. 1987 40 p
(Contract MIPR-HM0050-6-357)
(AD-A186010; NPS-82-87-001) Avail: NTIS HC A03/MF A01 CSCL 08B

This paper concerns the design of a computer vision system for change detection. Here, change detection is defined as figuring out the differences between an object model and the newly sensed image. The target objects are confined to the cultural features, such as roads and buildings. We divide the task into two modules: model verification and image interpretation. In this report, the verification stage will be discussed in detail. In general there exists a lot of domain specific heuristics to judge the status of changes. For example, to verify the existence of a building, we can check its shape, size, height, surface direction, and surface material, etc. The expert system approach is a natural approach which can code all information together. while different photo interpreters and field specialists may have different viewpoints about the status of an object, expert systems can be modified easily to reflect a particular viewpoint. GRA

N88-15279# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF NETWORK ATTRIBUTES FROM A HIGH RESOLUTION TERRAIN DATA BASE M.S. Thesis
Seok C. Choi Sep. 1987 98 p
(AD-A186078) Avail: NTIS HC A05/MF A01 CSCL 15E

The purpose of this research is to develop algorithms for mapping terrain characteristics from a 100 meter grid representation to arcs and nodes of a transportation network. The algorithms capture elevation and trafficability parameters as they relate to both the arc itself and to the off-arc characteristics. These network parameters are directly usable in appropriate optimization algorithms to determine minimum travel time path and minimum distance path through the network for a variety of maneuver unit types and missions. Author (GRA)

N88-15280# Institute of Oceanographic Sciences, Birkenhead (England).
REVIEW OF THE POTENTIAL OF SATELLITE REMOTE SENSING FOR MARINE FLOOD PROTECTION
J. M. Huthnance, ed., T. D. Allan, T. F. Baker, P. G. Challenor, K. R. Dyer, R. A. Flather, T. H. Guymer, I. D. James, and P. L. Woodworth 1987 61 p Prepared for the Ministry of Agriculture, Fisheries and Food, United Kingdom
(IOS-237; ETN-88-90937) Avail: NTIS HC A04/MF A01

Flood protection in the UK using satellite remote sensing techniques is discussed. Operational use is limited by widely spaced orbits with repeat periods of several days for any one polar-orbiting satellite, or by cloud cover for visible and infrared imagery spanning the orbit separation. Geostationary satellites have limited resolution at 50 to 60N. Research and design applications are numerous, with potential for monitoring climate and mean sea level change, overviews of coastal development, sediment movement and wave behavior, and establishing global wind and wave climatology.

Flooding may be imaged over that part of the UK sensed by ERS-1 in SAR mode at the time. Useful surge and wave data assimilation for forecasts awaits the Columbus program and requires its altimeters to have 0(2 cm) accuracy and to cover a swath 0(100 km) or more, as well as rapid data transmission and forecast model development. ESA

N88-15281*# National Academy of Sciences - National Research Council, Washington, D. C. Space Science Board.
REMOTE SENSING OF THE BIOSPHERE
Oct. 1986 145 p
(Contract NASw-3482)
(NASA-CR-182382; NAS 1.26:182382; PB88-100458) Avail: NTIS HC A07/MF A01 CSCL 04A

The current state of understanding of the biosphere is reviewed, the major scientific issues to be addressed are discussed, and techniques, existing and in need of development, for the science are evaluated. It is primarily concerned with developing the scientific capabilities of remote sensing for advancing the subject. The global nature of the scientific objectives requires the use of space-based techniques. The capability to look at the Earth as a whole was developed only recently. The space program has provided the technology to study the entire Earth from artificial satellites, and thus is a primary force in approaches to planetary biology. Space technology has also permitted comparative studies of planetary atmospheres and surfaces. These studies coupled with the growing awareness of the effects that life has on the entire Earth, are opening new lines of inquiry in science. GRA

N88-15282*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIRIS (HIGH-RESOLUTION IMAGING SPECTROMETER: SCIENCE OPPORTUNITIES FOR THE 1990S. EARTH OBSERVING SYSTEM. VOLUME 2C: INSTRUMENT PANEL REPORT
1987 89 p Original document contains color illustrations
(NASA-TM-89703; NAS 1.15:89703) Avail: NTIS HC A05/MF A01 CSCL 14B

The high-resolution imaging spectrometer (HIRIS) is an Earth Observing System (EOS) sensor developed for high spatial and spectral resolution. It can acquire more information in the 0.4 to 2.5 micrometer spectral region than any other sensor yet envisioned. Its capability for critical sampling at high spatial resolution makes it an ideal complement to the MODIS (moderate-resolution imaging spectrometer) and HMMR (high-resolution multifrequency microwave radiometer), lower resolution sensors designed for repetitive coverage. With HIRIS it is possible to observe transient processes in a multistage remote sensing strategy for Earth observations on a global scale. The objectives, science requirements, and current sensor design of the HIRIS are discussed along with the synergism of the sensor with other EOS instruments and data handling and processing requirements. Author

N88-15283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FROM PATTERN TO PROCESS: THE STRATEGY OF THE EARTH OBSERVING SYSTEM: VOLUME 2: EOS SCIENCE STEERING COMMITTEE REPORT
[1987] 153 p Original document contains color illustrations
(NASA-TM-89702; NAS 1.15:89702) Avail: NTIS HC A08/MF A01 CSCL 12B

The Earth Observing System (EOS) represents a new approach to the study of the Earth. It consists of remotely sensed and correlative in situ observations designed to address important, interrelated global-scale processes. There is an urgent need to study the Earth as a complete, integrated system in order to understand and predict changes caused by human activities and natural processes. The EOS approach is based on an information system concept and designed to provide a long-term study of the Earth using a variety of measurement methods from both operational and research satellite payloads and continuing ground-based Earth science studies. The EOS concept builds on the foundation of the earlier, single-discipline space missions designed for relatively short observation periods. Continued progress in our understanding of the Earth as a system will come from EOS observations spanning several decades using a variety of contemporaneous measurements. F.M.R.

N88-15284*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAR (SYNTHETIC APERTURE RADAR). EARTH OBSERVING SYSTEM. VOLUME 2F: INSTRUMENT PANEL REPORT
[1987] 260 p Original document contains color illustrations
(NASA-TM-89701; NAS 1.15:89701) Avail: NTIS HC A12/MF A01 CSCL 17I

The scientific and engineering requirements for the Earth Observing System (EOS) imaging radar are provided. The radar is based on Shuttle Imaging Radar-C (SIR-C), and would include three frequencies: 1.25 GHz, 5.3 GHz, and 9.6 GHz; selectable polarizations for both transmit and receive channels; and selectable incidence angles from 15 to 55 deg. There would be three main viewing modes: a local high-resolution mode with typically 25 m resolution and 50 km swath width; a regional mapping mode with 100 m resolution and up to 200 km swath width; and a global mapping mode with typically 500 m resolution and up to 700 km swath width. The last mode allows global coverage in three days. The EOS SAR will be the first orbital imaging radar to provide multifrequency, multipolarization, multiple incidence angle observations of the entire Earth. Combined with Canadian and Japanese satellites, continuous radar observation capability will be possible. Major applications in the areas of glaciology, hydrology, vegetation science, oceanography, geology, and data and information systems are described. J.P.B.

N88-15285*# Scripps Institution of Oceanography, La Jolla, Calif.
GEOSAT CROSSOVER ANALYSIS IN THE TROPICAL PACIFIC. PART 1: CONSTRAINED SINUSOIDAL CROSSOVER ADJUSTMENT Final Technical Report
Chang-Kou Tai 3 Feb. 1988 24 p
(Grant NAGw-808)
(NASA-CR-182391; NAS 1.26:182391) Avail: NTIS HC A03/MF A01 CSCL 22A

A new method (constrained sinusoidal crossover adjustment) for removing the orbit error in satellite altimetry is tested (using crossovers accumulated in the first 91 days of the Geosat non-repeat era in the tropical Pacific) and found to have excellent qualities. Two features distinguish the new method from the conventional bias-and-tilt crossover adjustment. First, a sine wave (with wavelength equaling the circumference of the Earth) is used to represent the orbit error for each satellite revolution, instead of the bias-and-tilt (and curvature, if necessary) approach for each segment of the satellite ground track. Secondly, the indeterminacy of the adjustment process is removed by a simple constraint minimizing the amplitudes of the sine waves, rather than by fixing selected tracks. Overall the new method is more accurate, more efficient, and much less cumbersome than the old. The idea of restricting the crossover adjustment to crossovers between tracks that are less than certain days apart in order to preserve the large-scale long-term oceanic variability is also tested with inconclusive results because the orbit error was unusually nonstationary in the initial 91 days of the GEOSAT mission.
Author

N88-15286*# Scripps Institution of Oceanography, La Jolla, Calif.
AN EFFICIENT ALGORITHM FOR COMPUTING THE CROSSOVERS IN SATELLITE ALTIMETRY Final Technical Report
Chang-Kou Tai 3 Feb. 1988 15 p
(Grant NAGw-808)
(NASA-CR-182389; NAS 1.26:182389) Avail: NTIS HC A03/MF A01 CSCL 22A

An efficient algorithm has been devised to compute the crossovers in satellite altimetry. The significance of the crossovers

is twofold. First, they are needed to perform the crossover adjustment to remove the orbit error. Secondly, they yield important insight into oceanic variability. Nevertheless, there is no published algorithm to make this very time consuming task easier, which is the goal of this report. The success of the algorithm is predicated on the ability to predict (by analytical means) the crossover coordinates to within 6 km and 1 sec of the true values. Hence, only one interpolation/extrapolation step on the data is needed to derive the crossover coordinates in contrast to the many interpolation/extrapolation operations usually needed to arrive at the same accuracy level if deprived of this information. Author

N88-15287*# Pacific Northwest Labs., Richland, Wash.
LANDSAT THEMATIC MAPPER RADIOMETRIC CALIBRATION STUDY
G. E. Wukelic, D. E. Gibbons, H. P. Foote, and L. M. Martucci Aug. 1987 7 p Presented at the Annual LANDSAT TM Investigators' Workshop, Santa Barbara, Calif., 1 Sep. 1987
(Contract DE-AC06-76RL-01830)
(NASA-CR-182410; NAS 1.26:182410; DE88-001965; PNL-SA-15199; CONF-8709179-1) Avail: NTIS HC A02/MF A01 CSCL 08B

The intent was to develop and test analytical techniques that will enhance the scientific and technical exploitation of digital multispectral data. The thrust involved radiometric calibration efforts aimed at determining the bias and validity in absolute temperature determinations using TM band 6 data. Other objectives included: looking at spectral characterization; change detection; combined reflective and emissive data use; and mixed pixel and atmospheric adjustments. To date, six TM data sets (five day scenes and one night scene) have been analyzed. Calibration accuracy of the water and non-water satellite-determined temperatures, using atmospherically corrected radiance values determined from LOWTRAN 6 with local radiosonde, non-local radiosonde, and LOWTRAN 6 model atmospheres, have been studied. Thermal values for non-water pixels have recently been determined. Extensive progress has been made in validating our calibration methodology, analyzing TM5-band 6 data sets for water and non-water pixels, verifying the mixed pixel and atmospheric adjustment methodologies, considering the quantitative effects of clouds and emissivities on absolute temperature determinations, and in conducting initial experiments relative to band 7 calibration. DOE

N88-15288 Deutsche Geodaetische Kommission, Munich (West Germany).
THE AEROPHOTOGRAMMETRIC DETERMINATION OF EARTH SURFACE DEFORMATIONS Ph.D. Thesis - Technische Univ., Brunswick, West Germany [ZUR AEROPHOTOGRAMMETRISCHEN ERMITTLUNG VON VERFORMUNGEN DER ERDOBERFLAECHE]
Peter Ladstaetter 1986 59 p In GERMAN
(Ser-C-321; ISBN-3-7696-9371-X; ISSN-0065-5325; ETN-88-90800) Copyright Avail: Issuing Activity

The deformation of a part of the tectonically active Krafla fissure swarms in Iceland was studied using the aerophotogrammetric method. Measurement of the image coordinates, calibration of the plotter, and the correction software are described. The determination of object coordinates and displacement vectors is explained. The aerotriangulation shows a 10 cm accuracy of the coordinates, suitable for the deformation analysis of phases with strong rifting. The vertical movement analysis requires a critical evaluation. Software improvements and the use of artificial covariance matrices are necessary. The mathematical model of bundle block adjustment has to be improved regarding self-calibration and image coordinate weighting. ESA

N88-15289 Deutsche Geodaetische Kommission, Munich (West Germany).
OPTIMIZATION OF PHOTOGRAMMETRIC IMAGE ADJUSTMENT Ph.D. Thesis - Stuttgart Univ., West Germany [OPTIMIERUNG DER PHOTOGRAMMETRISCHEN AUFNAHMEANORDNUNG]
Stephan Zinndorf 1986 79 p In GERMAN
(Ser-C-323; ISBN-3-7696-9373-6; ISSN-0065-5325; ETN-88-90801) Copyright Avail: Issuing Activity

Optimization processes used in geodetic surveys are introduced. Weighted optimization is useful for getting an optimal geodetic network. Analytic optimization is emphasized and is associated with the date definition of the network. The date problem must be solved, especially for weighted optimization. A clear storage of the network surveys is important. An optimization process can be used in free or associated networks. This process approaches the real covariance matrix of the network to an ideal matrix: the criterion matrice. This approach allows an improvement of the geometric arrangement of the shots. ESA

N88-15290 Deutsche Geodaetische Kommission, Munich (West Germany).
THEORY AND RESEARCH ON THE DISJUNCTION OF CROSS PASSAGE ERRORS AND SYSTEMATIC IMAGE ERRORS IN PHOTOGRAMMETRIC POINT DETERMINATION Ph.D. Thesis - Stuttgart Univ., West Germany [THEORIE UND UNTERSUCHUNG DER TRENNBARKEIT VON GROBEN PASSPUNKTFEHLERN UND SYSTEMATISCHEN BILDFEHLERN BEI DER PHOTOGRAMMETRISCHEN PUNKTBESTIMMUNG]
Deren Li 1987 123 p In GERMAN
(Ser-C-324; ISBN-3-7696-9374-4; ISSN-0065-5325; ETN-88-90802) Copyright Avail: Issuing Activity

Image error compensation is discussed. Ways for a better separation of gross passage errors and the systematic ones are: cross aerial photography with 20 percent superposing which gives the best performances (nearly equal to the double flight results with 60 percent superposing); the measuring of the double points especially when the passage points are weakly lined up; equalizing with a large group, the bundle presenting several images per surface. The gross passage errors are easier to separate from systematic image errors than gross passage points errors in between. ESA

N88-15291 Deutsche Geodaetische Kommission, Munich (West Germany).
OBSERVATIONS OF EARTH TIDES BY THE GERMAN GEODETIC RESEARCH INSTITUTE, DIVISION 1, IN THE PERIOD 1979-1985 AT THE BERCHTESGADEN AND WETTZELL STATIONS [ERDGEZEITENBEOBACHTUNGEN DES DEUTSCEN GEODAETISCHEN FORSCHUNGSINSTITUTS, ABT.1, IM ZEITRAUM 1979-1985 AUF DEN STATIONEN BERCHTESGADEN UND WETTZELL]
Harald Schmitz-Huebsch 1986 79 p In GERMAN; ENGLISH summary Original contains color illustrations
(Ser-B-280; ISBN-3-7696-8565-2; ISSN-0065-5317; ETN-88-90804) Copyright Avail: Issuing Activity

Temporal variations of the gravity vector were observed, using a gravity meter and a vertical pendulum of 30 m length in a salt mine in Berchtesgaden (West Germany) and 2 borehole-tiltmeters at the satellite observation station in Wettzell (West Germany). A comparison between both staticns shows that the Earth tide parameters depend on the geological structure. The amplitude factors of the partial tide M2 obtained from the pearl gneiss at Wettzell are lower by 18 percent in N-S direction and 4 percent in E-W direction than those derived from the softer clay anhydrite mixture at Berchtesgaden. For both stations stable preferential directions of the long-term drift can be given; they are consistent with the direction obtained from tectonic model computations and with the direction of the Central European stress field. ESA

N88-15292# GKSS-Forschungszentrum Geesthacht (West Germany).
THE INFLUENCE OF YELLOW SUBSTANCES ON REMOTE SENSING OF SEA WATER CONSTITUENTS FROM SPACE. VOLUME 1: SUMMARY
R. Doerffer, J. Fischer, H. Grassl, I. Hennings, R. Reuter, D. Diebel-Langohr, V. Amann, H. v.d.Piepen, V. Ittekot, and A. Spitzy (Hamburg Univ., West Germany) Paris, France ESA Dec. 1986 24 p
(Contract ESA-5953/84-NL-MD)

(ESA-CR(P)-2443-Vol-1; ETN-88-91138) Avail: NTIS HC A03/MF A01

The impact of Gelbstoff (yellow substance) on radiance spectra of the sea, and methods to incorporate Gelbstoff in an evaluation procedure of ocean color spectra measured at satellite altitude are discussed. Due to a large number of overlapping absorption bands Gelbstoff shows a continuous absorption decreasing exponentially from the blue to the red wavelengths without any minima; consequently there is no characteristic band for the location of a Gelbstoff channel in a spectrometer. The fluorescence shows a similar broad emission spectrum. The main fraction of Gelbstoff in the sea stems from river discharge; it can therefore be used as a tracer for investigations of water mass distribution and transport. The decay rate of Gelbstoff in the sea is slow and allows tracer studies in the time range of at least 15 to 20 days. Gelbstoff has a strong impact on water leaving radiance spectra: typical concentrations in estuaries reduce the radiance in the blue-green part of the spectrum by a factor 2 to 3. ESA

N88-15293# GKSS-Forschungszentrum Geesthacht (West Germany).

THE INFLUENCE OF YELLOW SUBSTANCES ON REMOTE SENSING OF SEA WATER CONSTITUENTS FROM SPACE. VOLUME 2: APPENDICES

R. Doerffer, J. Fischer, H. Grassl, I. Hennings, R. Reuter, D. Diebel-Langohr, V. Amann, H. v.d.Piepen, V. Ittekot, and A. Spitzy (Hamburg Univ., West Germany) Paris, France ESA Dec. 1986 257 p

(Contract ESA-5953/84-NL-MD)

(ESA-CR(P)-2443-Vol-2; ETN-88-91139) Avail: NTIS HC A12/MF A01

An uncharacterized fraction of dissolved organic carbon; the influence of yellow substance (Gelbstoff) on remote monitoring of water substances in coastal waters; optical properties of Gelbstoff; an inverse technique for remote detection and separation of substances in ocean water; an inverse technique for remote detection of suspended matter, phytoplankton, and yellow substances from CZCS measurements; long term stability of Gelbstoff concerning its optical properties; the selection of an optimized channel for measuring yellow substance from space within the 380 to 475 nm domain; ground truth techniques and procedures for Gelbstoff measurements; and airborne laser fluorosensor measurements of Gelbstoff are discussed. ESA

N88-15294# GKSS-Forschungszentrum Geesthacht (West Germany).

THE USE OF CHLOROPHYLL FLUORESCENCE MEASUREMENTS FROM SPACE FOR SEPARATING CONSTITUENTS OF SEA WATER. VOLUME 1: SUMMARY

R. Doerffer, J. Fischer, H. Grassl, I. Hennings, U. Kronfeld, K. Guenther, H. Haardt, P. Koske, V. Amann, and H. v.d.Piepen (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany) et al. Paris, France ESA Dec. 1986 41 p

(Contract ESA-5952/84-NL-MD)

(ESA-CR(P)-2444-Vol-1; ETN-88-91140) Avail: NTIS HC A03/MF A01

Sunlight stimulated fluorescence of marine phytoplankton and the transport of this signal to the top of the atmosphere as a method to map the distribution of phytoplankton in coastal areas of the sea from space were examined. Sun stimulated chlorophyll-a fluorescence at 685 nm is a generally detectable though small spectral feature in upward radiation spectra over the sea containing chlorophyll-a concentrations down to at least 1 mg/cum. Under typical coastal conditions very simple extraction algorithms give a linear dependence of chlorophyll fluorescence on chlorophyll concentration with a relatively low standard deviation. The primary productivity of marine algae is inversely related to in situ chlorophyll-a fluorescence. Suspended matter and Gelbstoff may induce problems. ESA

N88-15295# GKSS-Forschungszentrum Geesthacht (West Germany).

THE USE OF CHLOROPHYLL FLUORESCENCE MEASUREMENTS FROM SPACE FOR SEPARATING CONSTITUENTS OF SEA WATER. VOLUME 2: APPENDICES

R. Doerffer, J. Fischer, H. Grassl, I. Hennings, U. Kronfeld, K. Guenther, H. Haardt, P. Koske, V. Amann, and H. v.d.Piepen (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany) et al. Paris, France ESA Dec. 1986 467 p

(Contract ESA-5952/84-NL-MD)

(ESA-CR(P)-2444-Vol-2; ETN-88-91141) Avail: NTIS HC A20/MF A01

Biophysical processes of chlorophyll-a fluorescence; Sun stimulated chlorophyll fluorescence within a day-cycle; the daily cycle of in vivo chlorophyll-a fluorescence stimulated by artificial light sources; the effect of short term illumination changes on the Sun stimulated fluorescence of phytoplankton; chlorophyll fluorescence within the visible spectrum; horizontal and seasonal variability of species composition and phytoplankton chlorophyll in the Baltic and North Seas; scales of horizontal variability of chlorophyll-a phytoplankton; the influence of exceptional phytoplankton blooms on remote sensing of chlorophyll; masking of chlorophyll fluorescence by the atmosphere; ground truth measurement for primary production, production capacity, and fluorescence; use of airborne laser fluorometer as ground truth for satellite data evaluation; factor analysis of multispectral radiance over coastal and open ocean water based on radiative transfer calculations; effect of environmental factors and species composition on chlorophyll fluorescence of phytoplankton; and variability of excitation, emission, and absorption spectra normalized to the chlorophyll concentration are discussed. ESA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N88-15296# Colorado State Univ., Fort Collins.

MEAN AND PEAK WIND LOAD REDUCTION ON HELIOSTATS

J. A. Peterka, L. Tan, B. Bienkiewcz, and J. E. Cermak Sep. 1987 239 p

(Contract DE-AC02-83CH-10093)

(DE87-012281; SERI/STR-253-3212) Avail: NTIS HC A11/MF A01

This report presents the results of wind-tunnel tests supported through the Solar Energy Research Institute (SERI) by the Office of Solar Thermal Technology of the U.S. Department of Energy as part of the SERI research effort on innovative concentrators. As gravity loads on drive mechanisms are reduced through stretched-membrane technology, the wind-load contribution of the required drive capacity increases in percentage. Reduction of wind loads can provide economy in support structure and heliostat drive. Wind-tunnel tests have been directed at finding methods to reduce wind loads on heliostats. The tests investigated both mean and peak forces, and moments. A significant increase in ability to predict heliostat wind loads and their reduction within a heliostat field was achieved. In addition, a preliminary review of wind loads on parabolic dish collectors was conducted, resulting in a recommended research program for these type collectors. DOE

N88-15297# Johnson Controls, Inc., Milwaukee, Wis.

RESEARCH AND DEVELOPMENT OF ADVANCED LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, Dec. 1985 - Mar. 1987

M. G. Andrew and D. E. Bowman Apr. 1987 60 p

(Contract DE-AC08-86NV-10509)

(DE87-014661; DOE/NV-10509/1) Avail: NTIS HC A04/MF A01

The purpose was to develop an advanced lead-acid battery based on the concept of forced flow of electrolyte through porous electrodes for enhanced battery performance. The objectives were: specific energy of 42 Wh/kg, energy density of 70 Wh/l, and cycle life of 100 cycles. Accomplishments were: 35 flow-through cells with reduced construction time, higher fiber content in the positive active materials (PAM) with increased strength by a factor of 3, high-density PAM for increased life without utilization losses, confirmation of solid-state relaxation theory, methods for measuring permeability, 31 cycles achieved in C-450, oxygen recombination in many test cells, electrolyte reservoir can be below the top of the cells, and completed designs for positive and negative flow-through grids and for the injection molds to produce the grid/plastic laminates. DOE

N88-15298# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.

SATELLITE TECHNIQUES OF SOLAR RESOURCE ASSESSMENT FOR FOCUSING AND NON-FOCUSING SOLAR COLLECTOR SYSTEMS Final Report

C. G. Justus Sep. 1987 22 p

(Contract DE-FG02-84CH-10200)

(DE88-001657; DOE/CH-10200/3) Avail: NTIS HC A03/MF A01

The goal of this project is to produce an atlas of the solar energy resources of Saudi Arabia. This paper presents results of comparisons between direct and GOES satellite measurements of solar radiation in Saudi Arabia. Measurements made on the ground are plotted against estimates made from the satellite data. DOE

N88-15299# Ecole Nationale Superieure des Mines, Paris (France). Centre d'Energetique Armines.

SELF OPERATING ABSORPTION COOLING SYSTEM USING SOLAR ENERGY: SMALL POWER EXPERIMENTAL PLANT Final Report

P. Velluet and R. Dehausse 1986 89 p In FRENCH

(DE88-900194; EUR-9837) Avail: NTIS (US Sales Only) HC A05/MF A01

This study deals with a solar system for refrigeration specially designed for remote areas conditions. So, it must be very simple and reliable, and in addition it must be also mechanically self-operating. The thermodynamic cycle used is an ammonia-water absorption one. It consumes only thermal energy, which is easily and cheaply converted directly from solar radiation. In order to make a self-operating system, an engine is located between the boiler (at high pressure) and the absorber (at low pressure). It expands ammonia vapor and produces mechanical energy to run the solution pump. DOE

N88-15300# Skibsteknisk Lab., Lyngby (Denmark).

DATA ON EXISTING WIND ENERGY CONVERTERS IN DENMARK

E. T.D. Bjerregaard, S. A. Jensen, and U. S. Paulsen 1986 97 p

(DE88-900199; EUR-10790) Avail: NTIS (US Sales Only) HC A05/MF A01

The aim of this project has been to collect available data on existing wind energy converters (WEC) in Denmark. They have been collected on the basis of a general data sheet developed by ERA, UK, for common use by all EEC-participants in similar data collection projects in their respective countries. Per 1st January 1983 there were about 734 wind mills in operation in Denmark. The number of machines included in this project is 47, which represent different types with rated power between 3 kW and 2000 kW. Approximately half of the types reported are commercially available today. Different designs of wind turbines are represented, but the main part of the machines is a stall-regulated type with a three-bladed rotor and fixed blades placed upwind of the tower. The most common way of energy conversion is by means of one or two generators connected to the electric grid. Measured power curve characteristics are available for some of the machines, and the annual energy production has in those cases been calculated as a function of the annual mean wind speed. The present report contains a description of the procedure that has been used for the collection of the available data, a few remarks concerning the quality of the data, and in addition some general characteristics of the status of wind energy application in Denmark. DOE

N88-15301# Essen Univ. (West Germany). Inst. fuer Angewandtle Thermodynamik und Klimatechnik.

WORKING FLUIDS FOR SORPTION HEAT PUMPS Summary REport, 1 Jun. 1981 - 30 Sep. 1984

H. Bokelmann and H. J. Ehmke 1986 20 p

(DE88-900203; EUR-10725) Avail: NTIS (US Sales Only) HC A03/MF A01

All working fluid pairs which are presently used in domestic absorption heat pumps have certain disadvantages. A systematic search for suitable working fluid pairs has therefore been carried out. Alcohols and amines as solutions and different halides, nitrates and thyocyanates as solvents have been studied. Five of the most promising systems (TFE-NMP, R123a-DTG, Methylamine-Gly, R22-DTrG and NH3-LiNO3/H2O) were investigated in more detail. These investigations comprehended a complete measurement of the properties: vapor pressure, density and viscosity within the temperature range of interest. Also, calorific properties and vapor-liquid equilibria of some systems were determined. All measured data were correlated to equations which enabled a construction of diagrams for practical use. DOE

N88-15302# Wind Energy Group Ltd., Southall (England).

REALIZATION AND DEMONSTRATION OF A WIND TURBINE OF 200 kW DEMONSTRATION PROJECT Final Report

J. R. C. Armstrong, D. Lindley, R. Lord, and P. L. Rendall 1987 61 p

(DE88-900207; EUR-10995) Avail: NTIS (US Sales Only) HC A04/MF A01

This report describes the design, construction, and testing of an intermediate size wind turbine. The wind turbine was built from off-the-shelf components from various European manufacturers. After the machine was installed, performance data were gathered for several months and are presented in this paper. DOE

N88-15303# Commission of the European Communities, Ispra (Italy). Joint Research Centre.

THE RESULTS OF THE 1984/1985 ROUND-ROBIN CALIBRATION OF REFERENCE SOLAR CELLS FOR THE SUMMIT WORKING GROUP ON TECHNOLOGY, GROWTH AND EMPLOYMENT

H. Ossenbrink, R. VanSteenwinkel, and K. Krebs 1986 36 p

(DE88-900215; EUR-10613) Avail: NTIS (US Sales Only) HC A03/MF A01

In view of the necessity for common evaluation methods for photovoltaic devices, the Technology, Growth and Employment Working Group of the Summit initiated in 1984 a Round Robin Calibration of Reference Solar Cells in the frame of a Collaborative Project in Photovoltaic Solar Energy. This calibration campaign was performed successfully in 1984/1985 and included 18 crystalline and amorphous silicon solar cells from 5 different manufacturers. All summit countries contributed to the calibration, involving 8 experienced laboratories. The Joint Research Centre of the Commission of the European Communities, Ispra Establishment, performed the initial and final calibration and served as the operating agent. This report presents the results of the calibration and describes details of the calibration techniques used at the Joint Research Center. DOE

N88-15304# University Coll., Cardiff (Wales).

EVALUATION OF THERMAL STORAGE FOR SOLAR HEATING SYSTEMS: EXECUTIVE SUMMARY Final Report

R. Marshall 1987 48 p

(DE88-900219; EUR-10928) Avail: NTIS (US Sales Only) HC A03/MF A01

The purpose of this study is to develop mathematical relationships between solar thermal storage system parameters. Items studied are pipe losses, pump power, storage material heat transfer capacity, and thermal stratification. The goal of this study is the ability to predict a system's performance. DOE

N88-15305# Skibsteknisk Lab., Lyngby (Denmark).
COLLECTING OF NEW DATA ON EXISTING WIND ENERGY CONVERTERS Final Report
S. A. Jensen, E. T.D. Bjerregaard, and U. S. Paulsen 1986 77 p
(DE88-900221; EUR-10791) Avail: NTIS (US Sales Only) HC A05/MF A01

Measurements on a 55 kW VESTAS wind turbine were carried out during a period of approximately 2 months. The wind turbine is erected at a farm, and the produced energy is used for central heating and in cooling and drying systems at the farm. The energy production of the wind turbine is calculated as a function of the annual mean wind speed, and it is assumed that the wind speed frequency distribution is a Rayleigh distribution. The energy production during a period of 46 days from January the 20th to March the 7th 1983 was 20,665 kWh, and the total energy consumption by the owner in the same period was 12,983 kWh. The mean wind speed at hub height during the same period was 7.6 m/s. Approximately 8975 kWh or 69 per cent of the consumption was delivered directly from the wind turbine, and 11,690 kWh produced by the wind turbine was sold to the power supply company. DOE

N88-15306# Tennessee Valley Authority, Chattanooga. Div. of Conservation and Energy Management.
WATER SOURCE HEAT PUMP: HOW TO GET HOME HEATING AND COOLING FROM YOUR OWN BACK YARD
1987 10 p
(DE88-900180; TVA/OP/CEM-87/36) Avail: NTIS HC A02

Discussed is the advantage of using heat pumps to heat and cool dwellings. Water-source and ground-source heat pumps are described. DOE

N88-15621*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.
FURTHER STUDY OF INVERSION LAYER MOS SOLAR CELLS
Fat Duen Ho *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 16 p (For primary document see Summer Faculty Fellowship Program 16 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N88-15307# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
POLLUTION FROM MOTOR VEHICLES AND AIRCRAFT AT STAPLETON INTERNATIONAL AIRPORT (ABBREVIATED REPORT), REVISION 2
Howard M. Segal Sep. 1987 42 p
(AD-A185916; FAA/EE-86-11-A-Rev-2) Avail: NTIS HC A03/MF A01 CSCL 13B

The air quality impact of the proposed runway expansion program at Stapleton International Airport is determined in this report. The method of analysis is to model the dispersion of pollutants from motor vehicles and aircraft under both 1-hour and 8-hour worst case conditions. Results show that aircraft pollution concentrations are reduced and in some cases completely disappear when the new runways are added. This is caused primarily by a reduction in takeoff delays, which are a major objective of the runway expansion program at the airport. GRA

N88-15308# Colorado State Univ., Fort Collins. Dept. of Range Science.
SEMI-ARID ECOSYSTEM DEVELOPMENT AS A FUNCTION OF RESOURCE PROCESSING AND ALLOCATION Progress Report, 1 Jun. 1986 - 31 May 1987
E. F. Redente Sep. 1987 210 p
(Contract DE-FG02-86ER-60459)
(DE88-000890; DOE/ER-60459/1) Avail: NTIS HC A10/MF A01

Most studies of ecosystem development focus on the primary producers. This results in useful but restricted views of secondary successional processes. A more complete understanding of ecosystem development requires integrated study examining the primary producers, microflora and abiotic compartments of the system. This study focuses on the interrelationships between above- and belowground processes in semi-arid ecosystem development. We have examined primary production as well as decomposition, plant competition and changes in soil resource pools. Our main hypotheses link aboveground community structure to soil biological activity, development of the rhizosphere and mycorrhizal associations. Added to this are studies in plant life history strategies as well as physiological diversity of microorganisms to assure a more comprehensive understanding of secondary succession in semi-arid ecosystems. DOE

N88-15309# Resources for the Future, Inc., Washington, D. C.
IMPACTS OF WORLD DEVELOPMENT ON SELECTED CHARACTERISTICS OF THE ATMOSPHERE: AN INTEGRATIVE APPROACH. VOLUME 1: MAIN REPORT
J. Darmstadter, L. W. Ayres, R. U. Ayres, W. C. Clark, P. Crosson, P. J. Crutzen, T. E. Graedel, R. McGill, J. F. Richards, and J. A. Tarr Sep. 1987 164 p
(Contract DE-AC05-84OR-21400)
(DE88-001495; ORNL/Sub-86-22033/1-V1) Avail: NTIS HC A08/MF A01

This study presents estimates and analyses on atmospheric emissions associated with regional and global development and on environmental impacts caused by such emissions. The developmental activities covered are energy production and combustion, industrial processes, and agricultural practices. Some attention is directed as well to emissions resulting from natural processes, as distinct from those governed by human activity. The impacts studied on a regional basis are photochemical smog, precipitation acidity, and atmospheric corrosion. The global issue addressed is stratospheric ozone modification. The regions included are northeastern US, Europe, and the Gangetic Plain of India. In addition, some consideration is given to the Amazon Basin of Brazil. While the major part of the effort is directed to historical trends, illustrative 50- and 100-year projections are also presented. These point up the prospects of severe degradation in atmospheric quality resulting from emissions from a number of the developmental activities studied. These findings are presented more in qualitative than quantitative terms. Improvements in scientific understanding, data, and policy approaches are essential elements in conducting more refined research on these questions. DOE

N88-15310# Resources for the Future, Inc., Washington, D. C. Renewable Resources Div.
IMPACTS OF WORLD DEVELOPMENT ON SELECTED CHARACTERISTICS OF THE ATMOSPHERE: AN INTEGRATIVE APPROACH. VOLUME 2: APPENDICES
J. Darmstadter, L. W. Ayres, R. U. Ayres, W. C. Clark, P. Crosson, P. J. Crutzen, T. E. Graedel, R. McGill, J. F. Richards, and J. A. Tarr Aug. 1987 162 p
(Contract DE-AC05-84OR-21400)
(DE88-001496; ORNL/Sub-86-22033/1-V2) Avail: NTIS HC A08/MF A01

The following topics are addressed in this report: historical reconstruction of major atmospheric gaseous emissions in the US from 1880 to 1980; database and annotation; selected tables on methane, biomass and chlorofluorocarbons; and a statistical supplement to the historical reconstruction. DOE

N88-15311*# Delaware Univ., Lewes. College of Marine Studies.
SEASONAL CYCLING OF SULFUR AND IRON IN POREWATERS OF A DELAWARE SALT MARSH
George W. Luther, III and Thomas M. Church Feb. 1987 32 p (Grant NAG1-682)
(NASA-CR-182385; NAS 1.26:182385) Avail: NTIS HC A03/MF A01 CSCL 13B

An extensive pore water data set has been gathered in the Great Marsh, Delaware over various seasons, salinities, and tides. The data all point to a complimentary redox cycle for sulfur and iron which operates seasonally and tidally. Surface oxidizing conditions prevail in summer, with more reducing conditions at depth during the winter. During the spring tides which flood the marsh, pyrite oxidation occurs releasing excess dissolved iron (II) and sulfate to the porewaters, and precipitating authigenic solid iron phases. The redox conditions in the porewaters of the upper zone during the summer is poised between mildly oxidizing and mildly reducing conditions as shown by pE calculations. This redox environment and intermediate iron-sulfur redox species may be important for the stimulation of plant growth (photosynthesis) and sustenance of a viable microbial community (heterotrophy and chemoautropy). Author

N88-15312# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
USE OF BACK AIR TRAJECTORIES IN INTERPRETING ATMOSPHERIC CHEMISTRY DATA: A REVIEW AND BIBLIOGRAPHY
J. M. Miller Jun. 1987 34 p
(PB88-102108; NOAA-TM-ERL-ARL-155) Avail: NTIS HC A03/MF A01 CSCL 13B

One of the most important aspects of atmospheric chemistry is interpreting the measurements of different chemical species in terms of their cycles in the earth-atmosphere system. One method, the calculation of single back trajectories from the point of measurement, was widely and successfully employed to evaluate transport of chemical substances in the atmosphere. How the single trajectory analysis was applied in atmospheric chemistry is reviewed. The different models used, the methods of application, and the forms in which the results are presented are surveyed. Despite its limitations, the single back trajectory analysis method proved very useful in the interpretation of atmospheric chemistry data. Author

N88-15313# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
SUMMARY AND ANALYSIS OF COMMENTS ON THE RECOMMENDED PRACTICE FOR THE MEASUREMENT OF REFUELING EMISSIONS
Mar. 1987 130 p
(PB88-101530) Avail: NTIS HC A07/MF A01 CSCL 13B

As a result of concerns about the emissions which occur when gasoline vapors are displaced from fuel tanks during the refueling of motor vehicles, EPA has been examining the need for the control of these refueling emissions and the methods to do so. One such method involves the collection on the vehicle of the displaced hydrocarbons and the measurement of the effectiveness of the refueling vapor control system. The type of control is referred to as onboard control of refueling emissions. A summary is presented of the comments on the recommended refueling test procedure, EPA's analysis of the issues raised by the commenters, and the resulting changes made to the recommended test procedures. Author

N88-15314# Haut Commissariat a la Recherche, Algiers (Algeria). Centre d'Etudes Nucleaires et Solaires.
ATMOSPHERIC DIFFUSION AT COASTAL SITE IN PRESENCE OF SEA-BREEZE Ph.D. Thesis
M. Messaci Mar. 1987 125 p In FRENCH; In FRENCH
(DE88-700038; INIS-mf-10968) Avail: NTIS (US Sales Only) HC A06/MF A01

Coastal sites present special features as much by the dominant wind system as by the lower layers of the atmosphere. Two types of experiments were handled on a coastal site in the presence of a sea breeze. First, vertical atmospheric sounding was accomplished by radiosonde and balloons; then the discharge of a traced, SF6. The first experiment led to an emphasis on the position of the Internal Boundary Layer and the determination of its height. Whereas the second experiment allowed us to estimate the diffusion parameters of the site as well as to obtain interesting conclusions on diffusivity of the environment studied and the influence of certain factors. DOE

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N88-15315 Kansas State Univ., Manhattan.
PHONON DISPERSION FOR SEVERAL SURFACES WITH ORDERED OVERLAYERS: A LATTICE DYNAMICAL STUDY Ph.D. Thesis
Jin He 1987 166 p
Avail: Univ. Microfilms Order No. DA8715212

Calculations show that the nearest neighbor central force model which is used frequently in metals fails to explain the observed dispersions of the surface phonons of some surface structures. In the case of clean Ru(0001) surface, the two force constant model shows: interlayer and intralayer force constants with their ratio equal to 1.75, can give a good fit to the frequencies of the bulk and surface phonons at the bar Gamma and bar M points and in the dispersion of surface phonons along the line from bar Gamma and bar M. The phonon spectral densities for small-angle scattering by the absorbate vibrations were calculated for the (square root of 3 x the square root of 3)R30 deg oxygen overlayer on the Ru(0001) surface. It was found necessary to add the interaction between the absorbate atom and its second neighbor in the second substrate layer to the nearest neighbor central force interaction between all the atoms, to produce the distinct differences in the frequencies of the absorbate mass and low frequency modes for the fcc and hcp inequivalent threefold adsorption sites. Only with the inclusion of such an interaction can the observed gap in the Rayleigh wave frequency at the reduced Brillouin zone boundary and the presence of several modes along the bar Gamma-bar M direction for the oxygen overlayer on Pt(111). In the case of the same overlayer on Ni(100), this interaction can give a good fit to the data in the dispersion of the adsorbate modes along the bar Gamma-bar M direction and in the understanding of the origin of the low lying resonance modes in the spectrum. Dissert. Abstr.

N88-15316 Wisconsin Univ., Madison.
THE GLOBAL BALANCE OF DYNAMIC VORTICITY IN RELATION TO HEAT SOURCES AND SINKS Ph.D. Thesis
Martin Paul Hoerling 1987 272 p
Avail: Univ. Microfilms Order No. DA8714721

The maintenance of the global balance of dynamic vorticity, defined as the vertical component of the curl of the momentum vector, is investigated for January 1979. The diagnostics emphasize a three-dimensional perspective of the dynamic interaction between an ensemble of migratory cyclone-scale waves and the planetary-scale waves. The zonally and vertically integrated dynamic vorticity balance is also analyzed. The study is conducted within the isentropic framework using the ECMWF FGGE 3-b assimilated data set. Analysis reveals that the maintenance of the dynamic vorticity balance is thermally coupled to the differential heating of the Earth-atmosphere system. The Lagrangian source/sinks of dynamic vorticity for the Northern Hemisphere extratropics are associated primarily with the mean pressure solenoids and exhibit a prominent two-layered structure. Within the low troposphere of the Southern Hemisphere, the distribution of the Lagrangian source/sinks is determined by both the pressure

solenoids and the curl of the friction force. The diagnostic analysis within the upper troposphere reveals that the dynamic vorticity of the mean jets is maintained in part by a poleward transport of absolute vorticity occurring within thermally forced mass circulation. Maintenance of the polar-front jet is linked to a thermally direct geostrophic mass circulation within an ensemble of mature baroclinic disturbances. Maintenance of the subtropical jet is linked to a thermally direct poleward ageostrophic branch of the Hadley circulation. Dissert. Abstr.

N88-15317# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
MAXIE 1 (MAGNETOSPHERIC ATMOSPHERIC X-RAY IMAGING EXPERIMENT) PROGRAM Progress Report, 1 Jul. - 30 Sep. 1987
William L. Imhof, Henry D. Voss, and Victor Chinn 25 Sep. 1987 7 p
(Contract N00014-87-C-0050)
(AD-A185878; LMSC/0068447) Avail: NTIS HC A02/MF A01 CSCL 22B

The satellite flight of the MAXIE-1 (Magnetospheric Atmospheric X-ray Imaging Experiment) instrument is being implemented under ONR (the Office of Naval Research) sponsorship. The MAXIE-1 instrument is being developed as a joint activity of Lockheed, the Aerospace Corporation, and the University of Bergen; much of the Lockheed development has been done under the Independent Research Program. Under ONR sponsorship that institution is responsible for managing the program, for providing spacecraft interface requirements, for providing interface electronics for conditioning sensor signals, for developing test software and for conducting environmental tests needed for flight. This report describes some of the interface activities undertaken in the last three months, including meetings at NOAA and at RCA. GRA

N88-15318# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
NORSAR DETECTION PROCESSING SYSTEM Semiannual Technical Summary Report, 1 Oct. 1986 - 31 Mar. 1987
L. B. Loughran, ed. 31 May 1987 131 p
(Contract F08606-86-C-0004)
(AD-A185968; AD-F000114; NORSAR-SR-2-86/87) Avail: NTIS HC A07/MF A01 CSCL 17J

This Semiannual Technical Summary describes the operation, maintenance and research activities at the Norwegian Seismic Array (NORSAR). Investigations into further potential improvements in the NORSAR array processing system have continued. A new Detection Processor (DP) program has developed and tested in an off-line mode. This program is flexible enough to conduct both NORSAR and NORESS detection processing as is done today, besides incorporating improved algorithms. A wide-band slowness estimation technique has been investigated by processing data from several events from the same location. Ten quarry blasts at a dam construction site in western Russia and sixteen Semipalatinsk nuclear explosions were selected. The major conclusion from this study is that employing a wider frequency band clearly tends to increase the stability of the slowness estimates, provided the signal-to-noise ratio is adequate over the band of interest. The stability was found, particularly for Pn, to be remarkably good for the western Norway quarry blasts when using a fixed frequency band for each phase for all ten events. GRA

N88-15319# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
STATE-OF-THE-ART FOR ASSESSING EARTHQUAKE HAZARDS IN THE UNITED STATES. REPORT 26: PARAMETERS FOR SPECIFYING MAGNITUDE-RELATED EARTHQUAKE GROUND MOTIONS
E. L. Krinitzsky, Frank K. Chang, and Otto W. Nuttli Sep. 1987 103 p Prepared in cooperation with Saint Louis Univ., Mo.
(AD-A185997; WES/MP/S-73-1-26) Avail: NTIS HC A06/MF A01 CSCL 08K

A set of charts is presented that relate earthquake magnitude and distance from source to peak horizontal acceleration, velocity, and duration for hard and soft sites. The charts are in two groups: one for shallow plate boundary earthquakes with focal depths less than or equal to 19 km; another for subduction zone eqarthquakes with focal depths less than or equal to 20 km. The motions that are obtainable from these charts are for use where dynamic analyses are contemplated and cyclic loading is required that approximates the effect of earthquakes as they would be felt in the free field at an engineering site. GRA

N88-15320# California Univ., Los Angeles. Dept. of Physics.
ELECTRON ACCELERATION BY WAVE PROCESSES IN THE EARTH'S IONOSPHERE Final Technical Report, 15 Aug. 1985 - 31 Dec. 1986
G. J. Morales and J. E. Maggs 31 Dec. 1986 5 p
(Contract N00014-85-K-0538)
(AD-A186110) Avail: NTIS HC A02/MF A01 CSCL 04A

The nonlinear modification of the electron distribution function caused by the interaction with a resonant electrostatic field is studied analytically using a perturbation analysis. This interaction produces tail heating and for a limited range of parameter values can form a bump in the distribution, which may lead to emission of secondary waves. These results are applied to the ionosphere's F and upper E regions in the context of ionospheric modification experiments using ground-based powerful HF transmitters. An analytic study is made of the second order modifications produced on the fast tail electron distribution function of a nonuniform plasma subjected to resonant excitation by wave sources. The source models considered can represent excitation by external electromagnetic waves propagating obliquely to the plasma density gradient, mode-conversion of electrostatic whistlers, beat of two transparent electromagnetic waves, and direct conversion from ripples in the density profile. GRA

N88-15321# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ANALYSIS OF APPARENT-MOTION VECTORS IN, AND THE STRUCTURE OF, A MID-LATITUDE SPORADIC E LAYER USING A 2.66 MHz RADAR M.S. Thesis
Timothy D. Halderman 1987 103 p
(AD-A186126; AFIT/CI/NR-87-102T) Avail: NTIS HC A06/MF A01 CSCL 04B

We used the 2.66 MHz Imaging Middle-Atmosphere Geophysical Radar (IMAGER) located at Boot Lake, Colorado, to collect data on midlatitude sporadic E layers found near 100 km. Analysis of the data shows apparent-motion vectors, in a 20 km altitude range in and near the layers, of 200-300 m/s on one occasion and 160 m/s on another. In each case, these motions were toward the west and south. We interpret these results as phase motions of internal gravity waves, or ripples, moving through the lower thermosphere, rather than bulk wind motions. Possible lower atmosphere source regions for these internal gravity waves are identified. The sporadic E layers appeared to consist of irregularly shaped patches with scale sizes being approximately 15km. The heights of the individual patches appeared to vary as much as 3 km while the mean height of the layer varied from 106 km to as low as 96 km. We also had a 5-point tilting-filter photometer available which enabled us to calculate apparent-motions at similar altitudes. The results showed motion toward the north at approximately 100 m/s, significantly different, in both direction and speed, than the results from the radar. GRA

N88-15322# Naval Research Lab., Washington, D.C.
HOLOGRAPHY OF THE IONOSPHERE AT HIPAS
Stephen H. Knowles and Michael Andrews 5 Oct. 1987 30 p
(AD-A186237; NRL-MR-6084) Avail: NTIS HC A03/MF A01 CSCL 04A

The authors were tasked to investigate the Ionospheric Holography Experimental System undergoing development under UCLA auspices at HIPAS including both questions of engineering feasibility and of the validity of interpretation of the results in terms of extracting meaningful information about the ionosphere.

The conclusions in this report represent interactions with the U group through approximately mid-September 1986. GRA

N88-15323# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE SOLAR RADIATION INCIDENT AT THE TOP OF THE ATMOSPHERE OF URANUS AND NEPTUNE
E. VanHemelrijck 1987 33 p Submitted for publication
(Aeronomica-Acta-A-317-1987; ISSN-0065-3713; ETN-88-91101)
Avail: NTIS HC A03/MF A01

The latitudinal and seasonal variation of the direct solar radiation incident at the top of the atmosphere of Uranus and Neptune was calculated based on updating values for the period of axial rotation and the oblateness. Values for the solar radiation are given in W/sqm. The solar radiation averaged over a season and a year as a function of planetocentric latitude is reviewed. The ratio of the solar radiation incident on an oblate planet to that incident on a spherical planet is shown. ESA

N88-15324# Rome Univ. (Italy). Dipt. di Fisica.
LABORATORY MEASUREMENTS OF THE OZONE ABSORPTION COEFFICIENT IN THE WAVELENGTH REGION 339 TO 362 nm AT DIFFERENT TEMPERATURES
Marco Cacciani, Alcide diSarra, and Giorgio Fiocco 3 Jun. 1987 17 p Sponsored in part by Piano Spaziale Nazionale, and by Progetto Antartide
(Nota-Interna-882; ETN-88-91243) Avail: NTIS HC A03/MF A01

Instrumentation for the absolute measurement of the ozone absorption coefficient in the Huggins bands at different temperatures was set up. Ozone is produced with an electrical discharge and stored cryogenically; differential absorption measurements are carried out in a slowly evolving mixture of ozone and molecular oxygen. Results in the region 339 to 362 nm at temperatures between minus 30 and plus 40 C are reported. Results support Katayama's (1979) model of the transitions giving rise to the Huggins absorption bands of ozone. For measurements of atmospheric ozone profiles by DIAL techniques, the results on the temperature dependence of the absorption coefficient at the wavelength corresponding to the third harmonic of an NdYAG laser are stressed. ESA

N88-15325*# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
DYNAMICS EXPLORER GUEST INVESTIGATOR Semiannual Report No. 2
J. J. Sojka 1 Dec. 1987 68 p
(Grant NAG5-748)
(NASA-CR-181494; NAS 1.26:181494) Avail: NTIS HC A04/MF A01 CSCL 04A

Four objectives were accomplished during this reporting period. The visible auroral image conversion algorithms were compated with algorithms developed by Dr. M. H. Rees for data at different wavelengths. In the study 630 and 557 nm images were used to deduce the auroral energy flux and characteristic energy of the precipitating auroral electrons. The data for Southward IMF, B sub y negative conditions were collected and put into global format. A total of 55 sets of auroral images were obtained, and then converted to energy flux and characteristic energy data sets. The shortcoming of representing the high latitude convection pattern as a smooth function was written up and submitted to the Journal of Geophysical Research. A series of midlatitude corotational model runs were performed to quantitatively show how the F region varied as a function of electric field, topside number flux, and a topside heat source. B.G.

N88-15326# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
AEROSOL OPTICAL DEPTH AND RATIOS OF DIFFUSE-SKY TO TOTAL SOLAR IRRADIANCE MEASURED FROM AIRCRAFT FOLLOWING THE ERUPTION OF EL CHICHON
E. G. Dutton and J. J. DeLuisi Jun. 1987 37 p
(PB88-100789; NOAA-DR-ERL-ARL-12) Avail: NTIS HC A03/MF A01 CSCL 04A

Spectral aerosol optical depth and relative measurements of diffuse and total solar irradiance fields were made from an aircraft flying in the upper troposphere following the April 1982 eruption of El Chichon. Two series of flights were flown. The optical depth measurements reveal the latitudinal distribution of the stratospheric volcanic debris between 50 deg N and 6 deg S latitude the first flight and 72 deg N and 56 deg S for the next. The ratios of the downward diffuse to the downward total solar irradiance and albedo at aircraft altitude are given for times determined to be cloud free above the aircraft. The acquisition of and access to the data obtained on the flights is described, and edited results in summary graphical and tabular form are presented. Author

N88-15327# Lawrence Livermore National Lab., Calif.
ATMOSPHERIC HEATING FROM OPTICAL ABSORPTION BY AEROSOLS
D. H. Chambers and T. J. Karr 17 Sep. 1987 14 p
(Contract W-7405-eng-48)
(DE88-002654; UCID-21219) Avail: NTIS HC A03/MF A01

A model of aerosol heating of air is developed assuming instantaneous heating of spherical aerosol droplets. The first section presents the results for the temperature field around a spherical droplet produced by a train of heat pulses caused by absorption of a pulsed laser beam. The second section develops a statistical model of the full temperature field assuming the aerosol particle distribution can be described as a collection of Poisson points. The last section presents results for the total temperature distribution calculated for the temperature field in section 1. The model is developed for two spatial dimensions since the beam is affected only by the aerosol distribution integrated in the direction of propagation in the cases of practical interest. Generalization of this model to three spatial dimensions is straightforward. DOE

N88-15328 Deutsche Geodaetische Kommission, Munich (West Germany).
ANALYSIS AND SYNTHESIS OF THE EARTH'S GRAVITY FIELD VARIABLE IN SPACE AND TIME USING VECTOR SURFACE SPHERICAL FUNCTIONS Ph.D. Thesis - Stuttgart Univ., West Germany
Monika Lindlohr 1987 174 p In GERMAN; ENGLISH summary
(Ser-C-325; ISBN-3-7696-9375-2; ISSN-0065-5325;
ETN-88-90803) Copyright Avail: Issuing Activity

Analyzing with precision the general terrestrial gravity field, the conventionally used conservative vector field is replaced by a universal field representation which includes rotational effects. This representation can describe a nonrigid, deformable Earth. Vector surface spherical functions are introduced as base functions. The coefficients are derived by a weighted least squares approximation or by cubing the related integral representation. ESA

N88-15594# Joint Publications Research Service, Arlington, Va.
ASSESSMENT OF ANOMALOUS GRAVITATIONAL FIELD OF ELASTIC EARTH Abstract Only
Zh. S. Yerzhanov, A. A. Kalybayev, and A. N. Isayev *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 63 Transl. into ENGLISH from Izvestiya Akademii Nauk Kazakhskoy SSR: Seriya Fizikomatematicheskaya (Alma-Ata, USSR), Sep. - Oct. 1986 p 65-69 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15603*# Rice Univ., Houston, Tex. Dept. of Physics.
SOME CONSIDERATIONS ON MEASURING THE NEWTONIAN GRAVITATIONAL CONSTANT G IN AN ORBITING LABORATORY
Stephen D. Baker *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 7 p (For primary document see Summer Faculty Fellowship Program 7 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 08G

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N88-15329# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

THUNDERSTORMS WITH SNOW: A COMPREHENSIVE, EMPIRICAL STUDY OF THEIR OCCURRENCE, DEVELOPMENT AND STRUCTURE M.S. Thesis

Harold A. Elkins 1987 91 p

(AD-A185929; AD-F000114; AFIT/CI/NR-87-119T) Avail: NTIS HC A05/MF A01 CSCL 04A

A comprehensive, empirical study was undertaken to outline the characteristics of thunderstorms with snow. Occurrences are documented over a 17 year period (1971-87) and related to the development of mid-latitude cyclones. Emphasis is placed on the role of cold air motion as an integral part of the cyclone life cycle. Data indicates a cyclonic and anticyclonic tendency of the air depending on the stage of development. It also suggests the occlusion may not contain warm sector air. In order to understand the electrification process in a snowstorm the cloud physical microscale precipitation processes are analyzed. These are quantified and related back to the synoptic scale. From this, a conceptual model is created illustrating the structure of a thunderstorm with snow and is used to discuss the possible development. GRA

N88-15330# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

MIDDLE ATMOSPHERIC WIND MEASUREMENTS USING A MEDIUM FREQUENCY RADAR M.S. Thesis

Barry B. Coble 1987 67 p

(AD-A185931; AD-F000114; AFIT/CI/NR-87-123T) Avail: NTIS HC A04/MF A01 CSCL 04B

The Imaging Middle-Atmospheric Geophysical Radar was located at the Boot Lake, Colorado, field site and operated at 2.66 megahertz to collect radar data. The data presented here were collected from 2120 Universal Time to 2310 Universal Time on March 20, 1983. It was operated as a Doppler interferometer to measure winds in the middle atmosphere (16.5 - 91.5 kilometers), which includes the stratosphere and the mesosphere. Highly specular returns were obtained in the lower regions of the middle atmosphere, with specularity increasing as altitude decreased. Algorithms were developed to take these specular returns and derive useful wind speeds and directions in a region of the middle atmosphere, 30 - 55 kilometers, which had not previously yielded such information easily. Three-dimensional wind vectors were derived, and these values agreed well in direction, but overstated the magnitude when compared with rawinsonde data in the 16.5 - 30 kilometers region. The rawinsonde data were taken at Denver, Colorado, at time periods before and after the data run. GRA

N88-15331# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

DETERMINATION OF CLOUD BASE HEIGHT AND EMISSIVITY FROM DOWNWELLING ANGULAR RADIANCES M.S. Thesis

Janet L. Sorlin-Davis 1987 77 p

(AD-A185985; AFIT/CI/NR-87-93T) Avail: NTIS HC A05/MF A01 CSCL 04B

A technique has been devised which uses ground based radiance observations to estimate the base height and spectral emissivity of a homogeneous cloud layer. From the spectral emissivity, a broadband emissivity can also be deduced. An error sensitivity analysis was performed to simulate the effects of instrument errors. Model calculations at 10 micrometers and 11 micrometers showed that homogeneous cloud layers produce unique sets of ground radiance values over a range of zenith angles from o to 90 deg. By examining downwelling ground radiances at a very small zenith angle and a second zenith angle between 40 deg to 80 deg, one can distinguish between low emissivity low clouds and high emissivity high clouds. This is possible because the cloud emissivity and the atmosphere transmissivity beneath a cloud are dependent on the viewing angle, thus affecting how much radiation reaches the ground; as a result, this relationship differs for every cloud height and emissivity. GRA

N88-15332# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

RECENT COLORADO STATE UNIVERSITY TROPICAL CYCLONE RESEARCH OF INTEREST TO FORECASTERS Final Report, 22 Jun. 1983 - 21 Jul. 1984

William M. Gray Jun. 1987 119 p

(Contract N00228-83-C-3122; W05-13-CC)

(AD-A185996; NEPRF-CR-87-10) Avail: NTIS HC A06/MF A01 CSCL 04B

This report discusses new tropical cyclone research being conducted which may be used as background information by tropical cyclone forecasters. Observational findings and speculations address: (1) various climatological characteristics of tropical cyclones; (2) tropical cyclone formation; (3) tropical cyclone structural variability; (4) tropical cyclone intensity change; and (5) tropical cyclone outer radius wind distribution. GRA

N88-15333# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

TYPHOON STRUCTURAL EVOLUTION Ph.D. Thesis

Candis L. Weatherford 1987 214 p

(AD-A186090; AFIT/CI/NR-87-125D) Avail: NTIS HC A10/MF A01 CSCL 04B

Typhoon flight data from 750 aircraft reconnaissance missions into 101 named tropical cyclones of the northwestern Pacific Ocean are examined to study its changing life cycle structure. Flights were conducted at 700 mb. Life cycle changes are typified by three phases: 1) the entire vortex wind field builds as the cyclone intensifies to maximum intensity; 2) cyclone central pressure fills and maximum winds decrease in association with an expanding cyclone size and strengthening of the outer core (1 degree to 2.5 degree radius) winds; and 3) the entire vortex windfield decays. Aircraft radar reports of eyewall diameter are used to augment analysis of the typhoon's life cycle. The eye's character and diameter appear to reflect the ease with which the maximum wind field intensifies. On average, the eye first appears with intensifying cyclones at 980 mb central pressure. Cyclones which obtain an eye at a pressure higher than 980 mb intensify more rapidly, while those whose eye initially appears at lower pressures deepen at slower rates and typically do not achieve as deep a central pressure. The eye generally contracts with intensification and expands as the cyclone fills. By removing the symmetric portion of the tangential wind field of the vortex and the cyclone motion vector, the residual asymmetric wind flow in the cyclone's interior region (0-2.5 degree radius) can be studied for many different cyclone behavioral stratifications. GRA

N88-15334# Coastal Engineering Research Center, Vicksburg, Miss.

HURRICANE DANNY STORM SURGE DATA, REPORT 4

Andrew W. Garcia and William S. Hegge Aug. 1987 57 p

(AD-A186373; CERC-TR-87-11) Avail: NTIS HC A04/MF A01 CSCL 08C

A summary of storm surge high-water mark, hydrograph, and wave data acquired during and subsequent to Hurricane Danny is presented. Of particular interest are the wave data taken from an offshore oil platform located only 10 miles from the track of the hurricane. The data were obtained and assembled as part of a long -term research effort by the US Army Corps of Engineers to establish a quantitative data set with the objective of providing, in a series of documents, the data necessary for simulation and verification of numerical surge models. The data contained herein were obtained primarily by the US Army Engineers Waterways Experiment Station and the US Army Engineer District, Galveston, with supplemental data from contributing agencies and instructions. Additional information is included in the form of photographs and descriptive narrative to aid investigators in assessing the degree of importance of an individual measurement for the purpose of model verification. GRA

N88-15335# Coastal Engineering Research Center, Vicksburg, Miss.
HURRICANE KATE STORM SURGE DATA, REPORT 5
Andrew W. Garcia and William S. Hegge Aug. 1987 78 p
(AD-A186374; CERC-TR-87-12) Avail: NTIS HC A05/MF A01 CSCL 08C

A summary of storm surge high-water mark, hydrograph, and wave data acquired during and subsequent to Hurricane Kate is presented. The data were obtained and assembled as part of a long-term research effort by the US Army Corps or Engineers to establish a quantitative data set with the objective of providing, in a series of documents, the data necessary for simulation and verification of numerical surge models. The data contained herein were obtained primarily by the US Army Engineer District, Mobile, with supplemental data from contributing agencies and institutions. Additional information is included in the form of photographs and a descriptive narrative to aid investigators in assessing the degree of importance of an individual measurement for the purpose of model verification. GRA

N88-15336# National Oceanic and Atmospheric Administration, Rockville, Md. Federal Coordinator for Meteorological Services and Supporting Research.
FEDERAL PLAN FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH, FISCAL YEAR 1988
Apr. 1987 163 p
(PB88-118716; FCM-P1-1987) Avail: NTIS HC A08/MF A01 CSCL 04B

The report is focused on changes that are taking place in meteorological services and supporting research. The report is prepared for the specific purpose of complying with the requirements of Section 304, Public Law 87-843. It is published to provide the Congress and the Executive Branch with a coordinated, overall plan for government meteorological services and for research and development programs that directly support and improve meteorological programs. The plan covers all the programs of all the agencies for FY 1987 and FY 1988. Author

N88-15337# Woods Hole Oceanographic Institution, Mass.
SEQUAL (SEASONAL EQUATORIAL ATLANTIC) METEOROLOGICAL DATA FROM MOORINGS S2, S5 AND S6 (MARCH 1983 - MARCH 1985)
R. E. Payne Jul. 1987 44 p
(Grants NSF OCE-81-22061; NSF OCE-82-11108)
(PB88-108048; WHOI-87-30) Avail: NTIS HC A03/MF A01 CSCL 04B

Meteorological data are presented from three deployments of SEQUAL moorings S5 and S6 (nominal positions 0 N, 24 W and 0 N, 15 W) and also from a post SEQUAL deployment at SEQUAL mooring site S2 at 0 N, 28 W. Parameters recorded include vector averaged wind speed and direction, air and sea surface temperatures, insolation, barometric pressure, and relative humidity although not all parameters were recorded on all deployments. All deployments were nominally six months. GRA

N88-15338# Pacific Northwest Labs., Richland, Wash.
WIND AND TEMPERATURE STRUCTURE ON THE SLOPES OF A MOUNTAIN VALLEY
J. C. Doran, T. W. Horst, and C. D. Whiteman Aug. 1987 5 p Presented at the 4th American Meteorological Society's Conference on Mountain Meteorology, Seattle, Wash., 25 Aug. 1987
(Contract DE-AC06-76RL-01830)
(DE88-000080; PNL-SA-14947; CONF-870864-12) Avail: NTIS HC A02/MF A01

Wind and temperature measurements were made in a small valley in southeastern Washington. These measurements focused on the influence of the ambient valley wind and temperature structure on the development and structure of the winds and temperatures on the valley sidewalls. The effect of the sidewall slope flows on the development of the valley winds and temperatures is a considerably more difficult problem, because it involves the integrated result of many different influences, including the ambient synoptic conditions, the up- and down-valley topography, and so forth. In this paper we describe our measurements and present some preliminary observations and analyses. DOE

N88-15339# Lawrence Livermore National Lab., Calif.
THREE DIMENSIONAL DISPLAY OF METEOROLOGICAL SCIENTIFIC DATA
S. L. Grotch Sep. 1987 6 p Presented at the Digital Image Processing and Visual Communications Technologies in Meteorology Conference, Cambridge, Mass., 26 Oct. 1987
(Contract W-7405-eng-48)
(DE88-000776; UCRL-96580; CONF-8710161-1) Avail: NTIS HC A02

Three dimensional plotting can be used effectively to spatially represent data in ways which can greatly enhance understanding of meteorological parameters. Such presentations are not yet widely used in routine data analysis. However, to effectively utilize 3D graphics a number of features should be available to the user. DOE

N88-15340# Maryland Univ., College Park. Dept. of Meteorology.
OBJECTIVE PREDICTION OF MONTHLY MEAN SURFACE TEMPERATURE AND CLIMATOLOGICAL RELATIONSHIPS TO MID-TROPOSPHERIC HEIGHTS Final Report, 1 Nov. 1980 - 31 Oct. 1986
F. Baer and W. Klein May 1987 56 p
(Contract DE-AS05-81EV-10539)
(DE88-000908; DOE/EV-10539/6) Avail: NTIS HC A04/MF A01

This report describes the derivation, testing, and characteristics of multiple regression equations for specifying monthly mean surface temperature in extra-tropical portions of North America and Eurasia from concurrent fields of mean 700 mb height over most of the Northern Hemisphere, plus the previous month's local temperature. The geographical distribution and seasonality of the specification equations and of temperature persistence are discussed, and the synoptic climatology of surface temperature in relation to the 700 mb circulation is derived. Experiments aimed at refining the existing specification equations are described. Two methods appear promising: use of heights at the 500 mb level, instead of 700 mb, and screening the entire network of previous surface temperatures, instead of only the local value, as potential predictors. Attempts to develop an objective method for predicting, rather than specifying, monthly mean temperatures are discussed. Almost 10 percent of the temperature variance in the United States during the winter months can be explained by the previous month's field of 700 mb height, surface temperature and snow cover. DOE

N88-15341# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
LIGHTNING SPECTRA IN THE NEAR INFRARED
C. D. Weidman, A. Boye, and L. Crowell 28 Sep. 1987 34 p Presented at the American Geophysical Union Fall Meeting, San Francisco, Calif., 6 Dec. 1987 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex., and Analytic Decisions, Inc., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE88-002218; SAND-87-2571C; CONF-871219-1) Avail: NTIS HC A03/MF A01

Time resolved measurements of the spectra of rocket-triggered and natural lightning in the 0.85 to 1.4 micron wavelength interval were made during the summers of 1986 and 1987, in Florida, using a slitless spectrometer and a lead sulfide (PbS) vidicon detector with approximately 200 ms time resolution. The emissions from triggered discharges first became visible during the initial, continuing current portion of the discharge, tens to hundreds of milliseconds before the first return stroke. The brightest lines were observed above the triggering wire at 0.87 microns, a neutral atomic nitrogen NI multiplet, and in the upper one-half to one-third of the wire at 1.10, 1.17, 1.18, 1.24 and 1.25 microns. The latter emissions were neutral potassium multiplets. The NI multiplet at 0.87 microns

has previously been observed in natural lightning; three new emissions at 1.01 (brightest), 1.05, and 1.25 microns (least bright) were found later in the discharges, both in and above the wire portion of the channel. The NI emissions were often very bright in discharges with only very low peak current amplitude return strokes, which suggests that the intensity of the near IR emissions may be affected more by the intensity and duration of the continuing current or the total charge transfer than by the peak impulse current. The four NI multiplets were the most prominent features in natural lightning spectra. Lightning continuum emissions are clearly visible on some of the brighter spectra and, because the IR spectra were recorded at a range of 2.2 km from the triggered discharges, some of the spectral features seem to have been attenuated by atmospheric absorption. DOE

N88-15342# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

IMPROVEMENTS IN PROFILER WIND ESTIMATES USING SMOOTHED DATA IN THE SPECTRUM FINDER ALGORITHM

W. L. Eberhard Jun. 1987 32 p

(PB88-102181; NOAA-TM-ERL-WPL-147) Avail: NTIS HC A03/MF A01 CSCL 04B

Wind profilers obtain the component of wind velocity parallel to the radar beam by calculating the first moment of the Doppler spectrum. An effective data processing algorithm uses peak detection to locate the subset of the spectrum containing the Doppler signal before the mean frequency is calculated. Simulations showed that smoothing the data before finding the peak yields better accuracy when the signal to noise ratio is marginal. Sensitivity studies considered the dependence of the improvement on signal shape, smoother shape, number of spectral points, width of the signal spectrum, and number of spectra in the average, all as a function of signal to noise ratio. The effect of the smoother can also be interpreted as improved sensitivity with no loss of accuracy when signal to noise ratio is low. Simulations of consensus averaging demonstrated that the smoothed finder improves both the accuracy and effective sensitivity. Author

N88-15343# Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development.

SHORT REFERENCE YEARS: SHORT WEATHER DATA SETS FOR FASTER SIMULATIONS OF SOLAR ENERGY SYSTEMS AND ENERGY CONSUMPTION IN BUILDINGS

1986 49 p

(DE88-900198; EUR-10663) Avail: NTIS (US Sales Only) HC A03/MF A01

A Test Reference Year (TRY) is a collection of hourly weather data for a specific location and for 365 days arranged as 8760 sets of simultaneous weather parameters. A Short Reference Year (SRY) is a similar collection of data for less than 365 days. SRYs are, like TRYs, used as input data for computer simulation of heating or cooling loads in buildings, solar energy systems, energy consumption and indoor climate. With a substantial reduction in computer time, SRYs give nearly the same results as TRYs. They are, however, less suited for determination of extreme temperatures, or simulation of solar systems with long storage times. SRYs have been produced for 29 locations in 7 member countries of the Community and are presented here. DOE

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N88-15344# Coastal Engineering Research Center, Vicksburg, Miss.

ANNUAL DATA SUMMARY AND CLIMATOLOGICAL EVALUATION, CERC (COASTAL ENGINEERING RESEARCH CENTER) FIELD RESEARCH FACILITY, 1985, VOLUME 2, APPENDIX C Final Technical Report

Herman C. Miller, Adele Militello, Michael W. Leffler, William E. Grogg, and Michael M. Dominguez Sep. 1987 128 p

(AD-A185894; CERC-TR-87-13-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 08C

Wave data summaries for 1985 and climatological summaries for 1980 through 1985 are presented in this appendix. An explanation of the summary formats is followed by the data for Gages 625, 630, 640, and 645. Wave data are summarized in the following forms: gage histories; time-histories; annual, seasonal, and monthly maxima, mean, and standard deviations of wave height and peak period; distributions of wave height versus peak period; cumulative distributions of wave height; peak spectral wave period distributions of wave height; persistence of wave heights; wave roses; and spectra. GRA

N88-15345# Naval Underwater Systems Center, New London, Conn.

ACOUSTIC SCATTERING FROM COMPOSITE WIND-WAVE SURFACES 3: FORWARD SCATTER INTENSITIES AND SPATIAL COHERENCE AT LOW AND HIGH FREQUENCIES AND SMALL GRAZING ANGLES FOR BUBBLE-FREE REGIMES Technical Report, Oct. 1985 - Dec. 1986

David Middleton 23 Jan. 1987 62 p

(AD-A185908; NUSC-TD-7913) Avail: NTIS HC A04/MF A01 CSCL 20A

The present investigation continues the earlier studies of the author embodied in NUSC Technical Document TD-7025 and Technical Report TR-7635. Underwater acoustic scattering from the random moving wind-wave surface of the ocean is again considered. Specifically, one is now concerned with both high 0(5-20 kHz) and low 0(0.2-2.0kHz) frequency emissions and small grazing angles 0(less than or =25) with near-surface volume regimes which are effectively bubble-free for moderate to comparatively high mean wind states. GRA

N88-15346# Royal Australian Navy Research Lab., Edgecliff.

THE OCEAN HEAT BUDGET

J. W. Hill May 1987 49 p

(AD-A186130; RANRL-TN-3/87; AR-003-469) Avail: NTIS HC A03/MF A01 CSCL 08C

Methods are assembled for calculating the components of ocean heating/cooling from above, viz. short-wave radiation, albedo, longwave radiation, and evaporative and sensible heat exchange with the atmosphere. The aim is to secure the best possible balance between precision and simplicity, bearing in mind the inherent limitations of meteorological information. Much of the material comes from the literature, but a consolidation of the radiant heating input parameters and a simplification of the atmospheric heat exchange calculation are believed to be original developments. GRA

N88-15347# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF OFFSHORE CIRCULATION USING SATELLITE DATA AND FEATURE TRACKING TECHNIQUES M.S. Thesis

Gary R. Lennon Sep. 1987 41 p

(AD-A186271) Avail: NTIS HC A03/MF A01 CSCL 04B

Satellite-derived sea surface motion vectors are obtained for an area 100 to 300 kilometers from the central California coast south of Point Arena. These vectors are compared with hydrographic data acquired during the OPTOMA 21 cruise. Three

AVHRR images, with 24 hour spacing between images, are used to create two sets of sea surface flow vectors. The vectors obtained show only limited agreement with geostrophic velocities computed relative to 750 meters. There is good agreement when the geostrophic flow is strong and persistent submesoscale features are advected by the flow. Unfortunately this technique is only able to identify some of the strong flows and its utility for identifying weak (less than 10 cm/sec) flows is questionable. There are numerous eddies and perturbations in the surface flow in this area that cannot be resolved by this technique when the images are 24 hours apart. Cloud contamination in the second image emphasizes the dependence of this technique on an unobstructed view of the ocean. Nevertheless, when used with an understanding of its limitations the feature tracking technique can be a useful method of interpreting satellite oceanographic data. GRA

N88-15348# World Climate Programme, Geneva (Switzerland).
WOCE CORE PROJECT 2 PLANNING MEETING: THE SOUTHERN OCEAN
May 1987 64 p Meeting held in Bremerhaven, Federal Republic of Germany, 20-23 May 1986 Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WCP-138; WMO/TD-181; ETN-88-90773) Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

The role of the Southern Ocean in transporting heat, salt and other properties; and the strong ocean-atmosphere interactions and consequent water mass transformations were discussed. The Antarctic circumpolar current; meridional fluxes; and air sea ice interactions were treated. Scientific objectives; observational programs; and modeling requirements of field studies were determined. ESA

N88-15349*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIOGEOCHEMICAL CYCLING IN THE OCEAN. PART 1: INTRODUCTION TO THE EFFECTS OF UPWELLING ALONG THE WEST COAST OF NORTH AMERICA
John T. Howe May 1986 39 p
(NASA-TM-88230; A-86181; NAS 1.15:88230) Avail: NTIS HC A03/MF A01 CSCL 08A

Coastal upwelling is examined as it relates to the cycling of chemical species in coastal waters along the west coast of North America. The temporal and spatial features of upwelling phenomena in the Eastern boundary regions of the North Pacific Ocean are presented and discussed in terms of upwelling episodes. Climate conditions affecting upwelling include: thermal effects, wind-induced shear stress which moves surface layers, and the curl of the wind stress vector which is thought to affect the extent and nature of upwelling and the formation of offshore convergent downwelling fronts. These effects and the interaction of sunlight and upwelled nutrients which result in a biological bloom in surface waters is modeled analytically. The roles of biological and chemical species, including the effects of predation, are discussed in that context, and relevant remote sensing and in situ observations are presented. Climatological, oceanographic, biological, physical, chemical events, and processes that pertain to biogeochemical cycling are presented and described by a set of partial differential equations. Simple preliminary results are obtained and are compared with data. Thus a fairly general framework has been laid where the many facets of biogeochemical cycling in coastal upwelled waters can be examined in their relationship to one another, and to the whole, to whatever level of detail or approximation is warranted or desired. Author

N88-15350# Woods Hole Oceanographic Institution, Mass.
TIDE- AND WIND-FORCED CURRENTS IN BUZZARDS BAY, MASSACHUSETTS M.S. Thesis
R. P. Signell 1987 90 p Sponsored by NOAA, Rockville, Md. and Battelle Memorial Inst., Columbus, Ohio
(Grant NSF OCE-84-17769)
(PB88-110580; WHOI-87-15) Copyright Avail: NTIS HC A05/MF A01 CSCL 08C

Subtidal currents in Buzzards Bay were examined from six current meters on three moorings near the mouth from August 1984 to January 1985. Conditions were vertically well mixed over most of this period, and measurements made at 5 and 10 m in roughly 15 m of water show barotropic mean flow dominated by tidal rectification. These Eulerian mean observations are shown to be consistent with the predictions of a nonlinear numerical tidal model of the region, which indicates that the lower bay Eulerian mean field is dominated by small scale (2-5 km) tide-induced residual eddies with magnitudes of 105 cm/s. Subtidal current variability is polarized along the axis of the bay, and appears driven by local wind stress. GRA

N88-15351# Woods Hole Oceanographic Institution, Mass.
MOORED CURRENT METER DATA FROM THE CANARY BASIN NEAR 32 DEG N, 24 W (84-1986), VOLUME 40
S. A. Tarbell, P. L. Richardson, and J. F. Price May 1987 37 p
(Grants NSF OCE-82-14066; NSF OCE-86-00055)
(PB88-108105; WHOI-87-19-Vol-40) Avail: NTIS HC A03/MF A01 CSCL 08C

Data are shown from a two-year current meter mooring in the Canary Basin near 32 degrees N, 24 degrees W. Current meters were loacted at depths of 470, 970, 1070, and 2970 m during the period of October 19, 1984 to October 4, 1986. The mooring deployment is part of an 1984-1988 experiment to measure features of advection and diffusion of Mediterranean outflow water with neutrally buoyant SOFAR floats. GRA

N88-15352*# Scripps Institution of Oceanography, La Jolla, Calif.
ON ESTIMATING THE BASIN-SCALE OCEAN CIRCULATION FROM SATELLITE ALTIMETRY. PART 1: STRAIGHTFORWARD SPHERICAL HARMONIC EXPANSION Final Technical Report
Chang-Kou Tai 3 Feb. 1988 34 p
(Grant NAGw-808)
(NASA-CR-182387; NAS 1.26:182387) Avail: NTIS HC A03/MF A01 CSCL 08C

Direct estimation of the absolute dynamic topography from satellite altimetry has been confined to the largest scales (basically the basin-scale) owing to the fact that the signal-to-noise ratio is more unfavorable everywhere else. But even for the largest scales, the results are contaminated by the orbit error and geoid uncertainties. Recently a more accurate Earth gravity model (GEM-T1) became available, providing the opportunity to examine the whole question of direct estimation under a more critical limelight. It is found that our knowledge of the Earth's gravity field has indeed improved a great deal. However, it is not yet possible to claim definitively that our knowledge of the ocean circulation has improved through direct estimation. Yet, the improvement in the gravity model has come to the point that it is no longer possible to attribute the discrepancy at the basin scales between altimetric and hydrographic results as mostly due to geoid uncertainties. A substantial part of the difference must be due to other factors; i.e., the orbit error, or the uncertainty of the hydrographically derived dynamic topography. Author

51 LIFE SCIENCES (GENERAL)

N88-15353# Office of Naval Research, London (England).
REVIEW OF CYTOSKELETON RESEARCH IN CELL DIFFERENTIATION AND DEVELOPMENT
Claire E. Zomzely-Neurath 10 Sep. 1987 13 p Proceedings of 1st International Symposium on the Cytoskelton in Cell Differentiation and Development, Granada, Spain, 21-25 Apr. 1987
(AD-A185832; ONRL-7-024-C) Avail: NTIS HC A03/MF A01 CSCL 06D

Papers given at this conference, held in April 1987 in Granada, Spain, are reviewed. The papers focused on the analysis of the assembly dynamics of microtubules, intermediate filaments, and

action filaments to provide the structural basis of the role played by the cytoskeleton in differentiating a variety of cell systems, early embryogenesis, and to the biological and genetic aspects of cytoplasmic organization. GRA

N88-15354*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MICROGRAVITY PARTICLE RESEARCH ON THE SPACE STATION
Steven W. Squyres, ed., Christopher P. McKay, ed., and Deborah E. Schwartz, ed. Dec. 1987 48 p Workshop held in Moffett Field, Calif., 22-24 Aug. 1985
(NASA-CP-2496; A-87361; NAS 1.55:2496) Avail: NTIS HC A03/MF A01 CSCL 06B

Science questions that could be addressed by a Space Station Microgravity Particle Research Facility for studying small suspended particles were discussed. Characteristics of such a facility were determined. Disciplines covered include astrophysics and the solar nebula, planetary science, atmospheric science, exobiology and life science, and physics and chemistry. For individual titles, see N88-15355 through N88-15359.

N88-15355*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASTROPHYSICS AND THE SOLAR NEBULA **c29**
Joseph Nuth, Walter Duley, John Goebel, J. Mayo Greenberg, John Kerridge, Douglas Lin, Ian Mackinnon, Frans Rietmeijer, John Stephens, and Martin Tomasko (Arizona Univ., Tucson.) *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 3-9 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 22A

The following types of experiments for a proposed Space Station Microgravity Particle Research Facility are described: (1) nucleation of refractory vapors at low pressure/high temperature; (2) coagulation of refractory grains; (3) optical properties of refractory grains; (4) mantle growth on refractory cores; (5) coagulation of core-mantle grains; (6) optical properties of core-mantle grains; (7) lightning strokes in the primitive solar nebula; and (8) separation of dust from a grain/gas mixture that interacts with a meter-sized planetesimal to determine if accretion occurs. The required capabilities and desired hardware for the facility are detailed. J.P.B.

N88-15356*# Arizona State Univ., Tempe.
PLANETARY SCIENCE **c29**
John R. Marshall, Frank Bridges, Donald Gault, Ronald Greeley, Harry Houpis, Douglas Lin, and Stuart Weidenschilling (Planetary Science Inst., Tucson, Ariz.) *In* NASA. Ames Research Center, Moffett Field, Calif. Microgravity Particle Research on the Space Station Dec. 1987 p 11-18 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 03B

The following types of experiments for a proposed Space Station Microgravity Particle Research Facility are described: (1) low velocity collisions between fragile particles; (2) low velocity collisions of ice particles; (3) plasma-dust interaction; and (4) aggregation of finely-comminuted geological materials. The required capabilities and desired hardware for the facility are detailed. J.P.B.

N88-15357*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ATMOSPHERIC SCIENCE **c29**
Patrick Hamill, Thomas Ackerman, Antony Clarke, Jindra Goodman, Zev Levin, Martin Tomasko (Arizona Univ., Tucson.), O. Brian Toon, and Robert Whitten *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 19-24 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 04A

The following types of experiments for a proposed Space Station Microgravity Particle Research Facility are described: (1) growth of liquid water drop populations; (2) coalescence; (3) drop breakup; (4) breakup of freezing drops; (5) ice nucleation for large aerosols or bacteria; (6) scavenging of gases, for example, SO2 oxidation; (7) phoretic forces, i.e., thermophoresis versus diffusiophoresis; (8) Rayleigh bursting of drops; (9) charge separation due to collisions of rimed and unrimed ice; (10) charged drop dynamics; (11) growth of particles in other planetary atmospheres; and (12) freezing and liquid-liquid evaporation. The required capabilities and desired hardware for the facility are detailed. J.P.B.

N88-15358*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXOBIOLOGY AND LIFE SCIENCE **c29**
C. P. McKay *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 25-27 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 06B

The following types of experiments for a proposed Space Station Microgravity Particle Research Facility are described: (1) biogenic elements in the interstellar medium; (2) organic material in the solar nebula; (3) volatiles in comets and icy planetesimals; (4) pre-biotic atmospheric chemistry; (5) analysis of cosmic dust particles; and (6) microbial exposure. The required capabilities and desired hardware for the facility are detailed. J.P.B.

N88-15359*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSICS AND CHEMISTRY **c29**
Martin Moskovits, Lou Allamandola, Christopher Becker, Friedemann Freund, M. Freund, P. Haff, Jill Tarter, Otis Walton, David Weitz, and Brad Werner (California Inst. of Tech., Pasadena.) *In its* Microgravity Particle Research on the Space Station Dec. 1987 p 29-34 (For primary document see N88-15354 07-51)
Avail: NTIS HC A03/MF A01 CSCL 20C

The following types of experiments for a proposed Space Station Microgravity Particle Research Facility are described: (1) rheology of assemblies of inelastic, frictional particles; (2) grain dynamics in zero gravity; (3) properties of tenuous fractal aggregates; (4) orientation of weakly ferroelectric dust grains; (5) supersonic nozzle beam; and (6) some astrophysical cluster experiments. The required capabilities and desired hardware for the facility are detailed. J.P.B.

N88-15360# International Trade Administration, Washington, D.C.
BIOTECHNOLOGY IN WESTERN EUROPE
R. T. Yuan Apr. 1987 285 p
(PB88-105887) Avail: NTIS HC A13/MF A01 CSCL 06B

A technical and industrial assessment was carried out in the major industrial nations of Western Europe and the Far East. Its objectives were: to determine the government policies in support of biotechnology, to identify the principal research laboratories and their activities, to identify the principal companies involved in biotechnology and their activities, and to study the various mechanisms for technology transfer from the research laboratories to the industrial sector. In order to carry out the mission, two senior scientists were selected for posting to the U.S. Embassies in London and Tokyo. They were chosen on the basis of scientific expertise, work experience overseas, language proficiency, and the appropriate cultural affinities. Their efforts were coordinated through the International Trade Administration in Wash., D.C. Author

N88-15361*# Lockheed Engineering and Management Services Co., Inc., Washington, D.C.
USSR SPACE LIFE SCIENCES DIGEST INDEX TO ISSUES 10-14
Lydia Razran Hooke Washington NASA Feb. 1988 100 p
(Contract NASw-4292)
(NASA-CR-3922(17); NAS 1.26:3922(17)) Avail: NTIS HC A05/MF A01 CSCL 06B

An index is provided for issues 10 through 14 of the USSR Space Life Sciences Digest. There are two sections. The first section lists bibliographic citations of abstracts contained in the

Digest issues covered grouped by topic area categories. The second section provides a key word index for the same set of abstracts. Author

N88-15362# Arizona State Univ., Tempe. Dept. of Chemistry.
ARTIFICIAL PHOTOSYNTHESIS USING CHLOROPHYLL BASED CAROTENOID-QUINONE TRIADS Final Technical Progress Report
D. Gust and T. A. Moore Sep. 1987 9 p
(Contract DE-FG02-84CH-10198)
(DE88-001660; DOE/CH-10198/T1) Avail: NTIS HC A02/MF A01

Goal of this last year was the synthesis and study of a molecular tetrad consisting of a porphyrin or chlorophyll derivative covalently linked to both a carotenoid polyene and a rigid diquinone moiety. Photosynthesis converts light into chemical potential energy in the form of long-lived charge separation across a bilayer membrane. Recombination of the charge-separated state is prevented by the large distance between the final electron donor and acceptor. Reaction centers employ a series of electron transfer steps, each of which occurs over a short distance with high quantum yield. In photosynthetic bacteria, the charge separation sequence includes electron donation from a bacteriopheophytin to a quinone which then transfers an electron to a second quinone. The proposed carotenoid-porphyrin-diquinone (C-P-Q-Q) tetrad was designed to model this portion of the natural photosynthetic electron transport system, and to be the next step in the evolution of increasingly complex synthetic mimics of natural solar energy conversion. Such a tetrad has been prepared. Nanosecond laser flash photolysis and picosecond fluorescence decay studies were carried out. Electron transfer reactions in C-P dyads and C-P-Q triads were studied. DOE

N88-15363# European Space Agency, Paris (France).
PROCEEDINGS AND PROGRAM DRAFT IN GRAVITATIONAL BIOLOGY IN THE FEDERAL REPUBLIC OF GERMANY
Jun. 1987 143 p Transl. into ENGLISH of Gravitationsbiologie in der Bundesrepublik Deutschland - Vortraege und ein Programmentwurf (Cologne, Fed. Republic of Germany, DFVLR), Oct. 1985 194 p Proceedings held in Cologne, Fed. Republic of Germany, 14-15 Jun. 1985 Original language document was announced as N86-29514
(ESA-TT-988; DFVLR-Mitt-85-16; ETN-88-91110) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

The effects of weightlessness on animal organisms to better understand its effects on the human body during space flights are discussed. Investigations on vertebrate physiology, reproduction, genetics, neurobiology, and behavioral and motion physiology are proposed. For individual titles, see N88-15364 through N88-15381.

N88-15364# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
THE ROLE OF THE DFVLR PROJECT MANAGEMENT LIFE SCIENCES IN THE SPACE PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY
Ferdinand Dahl *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 10-16 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne (Federal Republic of Germany), Rept. DFVLR-MITT-85-16, Oct. 1985 p 9-20 Original language document was announced as N86-29515 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

The West German space program in cooperation with ESA and NASA is focused on the Spacelab 1 mission, on the Eureca mission, the Long Duration Exposure Facility, the International Microgravity Laboratory, Spacelab D2 mission, as well as on bioracks, European Radiation Assembly and Human Physiology Laboratory. Experiments are carried out in radiobiology, exobiology, physiology, botany, microbiology, rhythmic processes, and biotechnology. The DFVLR project management and the experiment/project selection procedure by the scientific advisory committees are presented. ESA

N88-15365# Stuttgart Univ. (West Germany).
A THEORETICAL CONCEPT FOR STATE CHANGES AND SHAPE CHANGES IN WEIGHTLESSNESS
Reto J. Strasser *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 17-25 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne (Federal Republic of Germany), Rept. DFVLR-MITT-85-16, Oct. 1985 p 23-31 Original language document was announced as N86-29516 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

A theoretical concept for state and shape changes in weightlessness based on thermodynamics principles for open systems is developed. The influence of light, temperature, pressure, and gravity on the shape and state of a biological system, and therefore on the phenotype with steady genome are studied. Experiments are carried out on leaves, chloroplasts, neurospores and mammalian cell spheroids. An experimental module for cellular biology was built for automatic optical and electrode measurements. The data are recorded, stored, and processed at a ground station. Experiments in space stations are recommended to study the influence of gravity and geomagnetism on the shape and the biochemical processes of a biological system and to obtain data on the phylogenesis of more complicated organisms. ESA

N88-15366# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
SOME REMARKS ON GRAVITATIONAL BIOLOGY
Wolfgang Briegleb *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 26-37 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne (Federal Republic of Germany), Rept. DFVLR-MITT-85-16, Oct. 1985 p 33-44 Original language document was announced as N86-29517 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

A functional system including direct/primary, indirect/secondary and various indirect/tertiary interactions between an organism and gravity was developed to study the genetic and phylogenic consequences of gravity on animals living in water or on land. Gravitational fields influence the gravity receptors leading to humoral or neuronal responses according to cell or proprioreceptor excitation. The immersed condition with no indirect gravity influence is compared with real weightlessness to analyze gravity direct influence on an isolated cell function or on a bunch of cells in egg ontogenesis and to analyze the effects of gravity on statocyst differentiation. In animals living on land, the antigravity structures and functions are influenced by gravity. The mutational effects of gravity leading to gene evolution through neuronal and functional morphological responses are presented. Hypergravity and weightlessness should be further studied. ESA

N88-15367# Konstanz Univ. (West Germany).
INVESTIGATIONS OF PARAMECIUM CELLS ANALYZED UNDER MICROGRAVITY CONDITIONS
Helmut Plattner *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 38-41 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne (Federal Republic of Germany), Rept. DFVLR-MITT-85-16, Oct. 1985 p 63-68Original language document was announced as N86-29520 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

Paramecium tetraurelia cells were studied using light microscopy, video recording, amino-ethyl dextran as redocking trigger agent and electronic microscopy to analyze exocytosis movements, redocking cycles on the cellular membrane and trichocyst building-up for 12 hr. The relationship between trichocyst ejection and motion behavior under microgravity conditions is studied using behavior mutants and secretion mutants to assess the negative or positive selection pressure of trichocyst presence or absence. ESA

N88-15368# Bonn Univ. (West Germany).
THE ORIGIN OF THE SPICULE SKELETON OF FRESH WATER SPONGES (SPONGILLIDES)
Norbert Weissenfels *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 42-44 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne (Federal Republic of Germany), Rept. DFVLR-MITT-85-16, Oct. 1985 p 47-52 Original language document was announced as N86-29518 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

Young fresh water sponges cultivated in the laboratory in constant temperature water and in ambient temperature were used to study the origin of the sponge spicule skeleton. The SiO_2 spicules are formed in scleroblasts. Aged spicules leave the scleroblasts and are transported by transport cells to their functional location where they adhere to the base plate through epongin which ensures their stability. The life cycle of the spongillides throughout the seasons is described. The influence of gravity on the development of young sponges should be studied. ESA

N88-15369# Cologne Univ. (West Germany).
LIMB REGENERATION IN AMPHIBIANS, A SUITABLE MODEL FOR INVESTIGATIONS OF THE EFFECTS OF WEIGHTLESSNESS AS REGARDS EVOLUTION AND MODIFICATIONS
Hermann Josef Anton *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 47-51 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 63-68 Original language document was announced as N86-29520 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

Limb regeneration in urodeles, amphibians which have experienced a phylogenetic evolution to overcome the effects of gravity, was studied to analyze the long term effects of weightlessness depending on environmental conditions and on gene activation. The study gives data on evolution processes and phylogenesis under weightlessness, on calcium exchange, and physiological regeneration of the skeleton as a supporting and moving apparatus. ESA

N88-15370# Ruhr Univ., Bochum (West Germany).
INVESTIGATIONS OF THE REPRODUCTIVE PHYSIOLOGY OF THE RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON)
Volker Bluem and Ruediger Schulz *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 52-55 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 69-73 Original language document was announced as N86-29521 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

Morphological and endocrinal investigations on the reproductive physiology of the rainbow trout of either sex were performed to study hypothalamic production of gonadotropin releasing hormone (GnRH) using histological and histometrical analysis, to demonstrate the presence of gonadotrop hormone receptors (GTH-receptors) in testes and ovaries based on radioimmunological quantification and using the immunofluorescent technique. An in vitro system for gonad tissues was developed to study steroid genesis in short-time cultures. The effects of puberty in rainbow trout on material exchange are studied. Ethiological studies were carried out to determine the influence of sexual and/or parental phases. The morphological control of gametogenesis in micro-g environment is recommended as well as in vivo and in vitro investigations of reproduction-dependent hormonal systems. ESA

N88-15371# Essen Univ. (West Germany).
CHANGES IN THE MORPHOLOGICAL AND MOLECULAR BIOLOGICAL PROCESSES DURING EARLY EMBRYO DEVELOPMENT IN AMPHIBIANS UNDER MICRO-g CONDITIONS
Horst Grunz *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 56-60 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne (Federal Republic of Germany), Rept. DFVLR-MITT-85-16, Oct. 1985 p 75-80 Original language document was announced as N86-29522 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

The effects of micro-g conditions on vegetative polarity (absence of change) in aging oocytes over 2 months were studied to determine the role of gene regulatory factors and the changes in nucleus-cytoplasm interactions. Cell affinity and induction should be investigated under micro-g conditions to study the processes of the reaggregation between ectoderm and endoderm and the changes in the standard structure so as to understand normal and pathological embryo development. ESA

N88-15372# Justus Liebig-Universitaet, Giessen (West Germany).
XIPHOPHORUS: A SYSTEM TO RECOGNIZE RADIATION-INDUCED MUTATIONS AND TO STUDY THE EFFECTS OF ZERO-GRAVITY ENVIRONMENT ON EMBRYO DEVELOPMENT
Carl-Rudolf Schmidt and Fritz Anders *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 61-65 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 81-85 Original language document was announced as N86-29523 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

The reproduction physiology of Xiphophorus is described. Laboratory mutants constitute a system of 60 stable and genetically determined species. Resulting from their crossbreeding melanomas appear due to a disorded oncogene. The Xiphophorus system is studied to determine the oncogene characteristics, regulation and transmission. Studies on Xiphophorus under weightlessness are recommended: influence of zero-g environment on skeleton and musculosketal structure; epigenetic and/or genetic effects of zero-g environment on embryogenesis in vivo and in vitro; and the effects of the combined action of cosmic radiation and weightlessness on embryos, sub-adult and adult animals of the mutation-sensitive Xiphophorus test species to investigate mutagenesis and teratogenesis. ESA

N88-15373# Luebeck Univ. (West Germany).
HYPOXIC HYPOXIA AS A STIMULUS OF ERYTHROPOIESIS IN VIVO AND IN VITRO

Wolfgang Jelkmann *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 70-75 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 95-100 Original language document was announced as N86-29524 (For primary document see N88-15363 07-51)
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The action of weightlessness on red blood volume in astronaut's anemia and on erythropoiesis leading to increased hemolysis is studied. Several generations of mice and rats bred in weightlessness were studied to determine the effects of weightlessness on the erythropoetic tissues, in erythropoiesis and on calcification. Causes of astronaut's anemia are listed. The effects of weightlessness on the erythropoietic system ontogenesis were measured based on circulative blood and erythrocyte volumes, the functional integrity of the hematopoietic tissue and the capacity of the erythropoietic system to react to hypoxia. ESA

N88-15374# Marburg Univ. (West Germany).
A LEARNING MODEL AS A BASIS FOR INVESTIGATIONS OF THE EFFECTS OF GRAVITY ON THE LEARNING PROCESSES AND MEMORY FORMULATION
Christiane Buchholtz *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 79-84 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 107-113 Original language document was announced as N86-29525 (For primary document see N88-15363 07-51)
Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 50

The effects of gravity on learning strategy were studied using conditioned mice and a data acquisition computer system recording the daily performance of each mouse. The records are used to develop learning models. Increasing gravity causes changes in the functional relationship between data storage units. These changes depend on the calculation result of proprioceptive feedbacks, and on time dependent effects represented by transmission of data from a short term memory related to the biophysical phase to long term memory related to the biochemical phase. ESA

N88-15375# Duesseldorf Univ. (West Germany).
LONG-TERM ADAPTATION OF THE OTOLITH ORGANS
Rolf Eckmiller *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 85-90 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 115-120 Original language document was announced as N86-29526 (For primary document see N88-15363 07-51)
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Reduction in sensitivity of otolith organs in primates before a space mission and methods to reduce it were investigated to avoid space motion sickness. A procedure should be developed under neurophysiological control of the otolith afferences to influence the size and location of otoconia. ESA

N88-15376# Ulm Univ. (West Germany).
FUNCTIONAL DEVELOPMENT OF GRAVITY RECEPTORS IN INSECTS AND AMPHIBIANS
Eberhard Horn *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 91-98 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 121-128 Original language document was announced as N86-29527 (For primary document see N88-15363 07-51)
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Insects using a proprioceptive system and amphibians using a statocyst were studied to analyze the functional development of a sensory system and its influence of the body muscle structure. The effects of micro-g through gravity receptors on the efficiency of the sensory system, on the adaptative mechanisms of the neuronal development under changing living conditions or under the animal pathological conditions, and on the hormonal environment are studied. The studies are based on eye reflex (Xenopus) and head reflex (Gryllus) and on equilibrium observations. ESA

N88-15377# Stuttgart Univ. (West Germany).
FUNCTION-DEPENDENT PLASTICITY IN THE NERVOUS SYSTEM
Hinrich Rahmann and Wolfgang Probst *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 101-105 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 135-139 Original language document was announced as N86-29528 (For primary document see N88-15363 07-51)
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The tectum opticum of fish midbrain is studied to demonstrate the involvement of gangliosides in the functional plastic changes in synaptic systems and in visual acuity. The structural synaptic plasticity after light variations involving synaptic vesicles and after temperature variations involving the nervous system are studied using differential quantitative light and electronic microscopes. The biochemical neuronal plasticity after temperature variations involves sialo-glycoconjugate bonds and gangliosides. The molecule basic properties are determined using the monolayer technique for physico-chemical in vitro experiments with various neuronal membrane lipids combined with calcium ions. Further investigations are recommended to study neuronal plasticity in reduced or in absence of gravity. ESA

N88-15378# Bonn Univ. (West Germany).
MORPHOLOGY AND DEVELOPMENT OF THE INNER EAR OF ANURANS
Hans Schneider and Iris Hertwig *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 106-109 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 141-146 Original language document was announced as N86-29529 (For primary document see N88-15363 07-51)
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The Anuran inner ear consists of five sensory sections for orientation in space and perception of acoustic signals. Utriculus, sacculus and lagena are gravity receptors possessing otoliths. The ampullae of the semicircular canals are responsible for rotation sense. Papillia basilaris and papilla amphiborum allow respectively perception of high frequencies and low frequencies. The development of the labyrinth in amphibians begins after neurulation. The receptors consist of sensory cells and support cells. Experiments in simulated weightlessness show that the development of sensory epithelia and otoliths do not depend on gravity and should be confirmed by experiments in space. ESA

N88-15379# Bielefeld Univ. (West Germany).
QUESTIONS ON THE EVOLUTION OF THE DEVELOPMENT PROGRAM OF THE VERTEBRATE INNER EAR UNDER LONG TERM ZERO-g CONDITIONS
Bernd Fritzsch *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany

(DFVLR-Mitt-85-16) Jun. 1987 p 112-116 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 151-156 Original language document was announced as N86-29530 (For primary document see N88-15363 07-51)
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The long-term effects of weightlessness on the formation and function of the vestibular system are studied with particular focus on the persistence of motion defects of larva up to adult age, on the reproduction function, on the adaptation or selection of the offspring and hybrids resulting from successful reproduction under weightlessness, and on the sensory epithelium differentiation. The structural changes of the inner ear in adapted or selected offspring are studied using the electronic microscope and the afferent and efferent connections using tracer methods. High generation succession frequency and offspring number, applicable reproductive behavior and easy culture, and live food are the minimum requirements for program implementation. ESA

N88-15380# Kiel Univ. (West Germany).
LONG DURATION CONFINEMENT OF AQUATIC ORGANISMS IN WEIGHTLESSNESS (AQUASPACE)
Rainer Froese *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 117-122 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 159-164 Original language document was announced as N86-29531 (For primary document see N88-15363 07-51)
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A confinement facility resulting from the study of the transition phase between water and air was developed to study aquatic organisms in weightlessness. The facility is a closed system filled with water and consists of a central supply unit, confinement tanks, a lock system, a computer system for food supply control and measurement processing, videocameras monitoring growth, reproduction and behavior of the aquatic organisms, and two chambers to remove the gases released in water through a diffusion membrane and to store oxygen in a gas mixture. The facility can be used to study the catabolism of the aquatic organisms in weightlessness and the effects of weightlessness and radiation on the reproduction biology. ESA

N88-15381# Ulm Univ. (West Germany).
PROGRAM DRAFT FOR A SPECIAL FIELD: GRAVITATIONAL BIOLOGY
Eberhard Horn *In its* Proceedings and Program Draft in Gravitational Biology in the Federal Republic of Germany (DFVLR-Mitt-85-16) Jun. 1987 p 127-142 Transl. into ENGLISH from Gravitationsbiologie in der Bundesrepublik Deutschland-Vortraege und ein Programmentwurf, DFVLR, Cologne, Federal Republic of Germany, Rept. DFVLR-Mitt-85-16, Oct. 1985 p 173-189 Original language document was announced as N86-29532 (For primary document see N88-15363 07-51)
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Gravitational biology as a special field for fundamental research or organism biology in weightlessness is discussed. Cellular and molecular biology, genetics; reproduction and development biology; vegetative biology and matter exchange biology; neurobiology; behavioral and motion physiology; population genetics, and evolution biology, and ecology and life preservation systems are suitable fields of research. The cooperation between the different field specialists and experts can contribute to the knowledge of body stabilization and plasticity and adaptativity in weightlessness. ESA

N88-15396# Joint Publications Research Service, Arlington, Va.
KARYOMETRIC EVALUATION OF NEURONAL REACTIONS OF RAT CEREBRAL CORTEX TO THE COMBINED EFFECT OF IONIZING RADIATION, LONGITUDINAL ACCELERATIONS AND VIBRATION
V. P. Fedorov and I. B. Ushakov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 56-60 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 39-42 (For primary document see N88-15389 07-52)
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N88-15403# Joint Publications Research Service, Arlington, Va.
SPLEEN LYMPHOCYTE NUCLEIC ACIDS IN PREGNANT RATS FLOWN IN SPACE AND THEIR OFFSPRING
G. S. Komolova, V. F. Makeyeva, I. A. Yegorov, and L. V. Serova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 98-101 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 66-69 (For primary document see N88-15389 07-52)
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N88-15404# Joint Publications Research Service, Arlington, Va.
DISTINCTIVE CHANGES IN ARTERIAL PRESSURE AND BLOOD FLOW IN COMMON CAROTID ARTERY OF MONKEYS FLOWN ABOARD COSMOS-1514 BIOSATELLITE
V. P. Krotov, H. Sandler, A. M. Badakva, J. Hines, V. S. Magedov, and H. Stone *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 102-108 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 69-74 (For primary document see N88-15389 07-52)
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N88-15411# Joint Publications Research Service, Arlington, Va.
THIRD SOVIET-FRENCH SYMPOSIUM ON SPACE CYTOLOGY
I. B. Krasnov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 138-143 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 92-95 Symposium held in Reims, France, 4-11 May 1986 (For primary document see N88-15389 07-52)
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N88-15414# Joint Publications Research Service, Arlington, Va.
EXPERIMENTS WITH RATS FLOWN ABOARD COSMOS-1667 BIOSATELLITE (MAIN OBJECTIVES, CONDITIONS AND RESULTS)
O. G. Gazenko, Ye. A. Ilyin, Ye. A. Savina, L. V. Serova, A. S. Kaplanskiy, V. S. Oganov, I. A. Popova, K. V. Smirnov, and I. V. Konstantinova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 8-16 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 9-16 (For primary document see N88-15412 07-52)
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N88-15415# Joint Publications Research Service, Arlington, Va.
BRAIN MORPHOGENESIS IN RATS DEVELOPING IN WEIGHTLESSNESS
I. B. Krasnov, S. N. Olenev, I. I. Babichenko, and V. S. Kesarev *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 17-24 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 16-22 (For primary document see

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N88-15417# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC ANALYSIS OF RAT AORTA ENDOTHELIUM DURING LONG-TERM HYPOKINESIA
A. N. Gansburgskiy *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 32-35 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 26-28 (For primary document see N88-15412 07-52)
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NUCLEIC ACID CONTENT OF SKELETAL MUSCLES DURING HYPOKINESIA AND IN THE RECOVERY PERIOD
D. Z. Shibkova and N. A. Fomin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 36-40 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 28-31 (For primary document see N88-15412 07-52)
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ACID-BASE EQUILIBRIUM AND SOME RAT BLOOD PARAMETERS FOLLOWING EXPOSURE TO HYPERBARIC OXYGENATION
V. V. Gladilov and N. A. Moyseyenko *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 56-61 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 41-45 (For primary document see N88-15412 07-52)
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N88-15423# Joint Publications Research Service, Arlington, Va.
CHANGES IN FUNCTIONAL PARAMETERS OF ANIMALS DURING LONG-TERM INHALATION OF ACETIC ACID
V. P. Savina and B. V. Anisimov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 79-84 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 56-60 (For primary document see N88-15412 07-52)
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N88-15425# Joint Publications Research Service, Arlington, Va.
EFFECT OF PYROCETAM ON MOUSE RESISTANCE TO HYPOXIC HYPOXIA 2-3 MONTHS AFTER EXPOSURE TO X-RADIATION
A. V. Popov, A. A. Bochenkov, Yu. Yu. Ivnitskiy, and Yu. V. Volkovskiy *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 91-95 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 64-66 (For primary document see N88-15412 07-52)
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N88-15430# Joint Publications Research Service, Arlington, Va.
EFFECT OF STEROID HORMONES ON BIOGENIC AMINE LEVELS IN LUNGS DURING DEVELOPMENT OF PULMONARY HYPERTENSION IN RATS SUBMITTED TO CHRONIC HYPOBARIC HYPOXIA
N. N. Pribylova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 114-117 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 76-78 (For primary document see N88-15412 07-52)
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52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N88-15382# Army Research Inst. of Environmental Medicine, Natick, Mass.
ASSESSMENT OF PHYSICAL ACTIVITY INTENSITY BY HEART RATE DURING SLEEP LIMITED MILITARY OPERATIONS
Robert P. Mello, James A. Vogel, John F. Patton, III, and Bruce H. Jones 1987 20 p
(AD-A185913) Avail: NTIS HC A03/MF A01 CSCL 06D

This study estimated the intensity of physical activity of infantrymen by means of continuous heart rate (HR) recordings during a combat-simulated 5-day field operation. Subjects rotated daily through 4 different combat-simulated field maneuver areas and repeated the first day's schedule on the fifth day. Soldiers slept approximately 5 hours per night and physical activity was monitored by taping HR with Oxford-Medilog cassette recorders. Daily HR (excluding sleep and resupply time) decreased to a mean of 101 beats per min (bpm) on day one to a mean of 89 bpm on day five. A 10 km road march proved to be the single most demanding event. It is suggested that: (1) continuous cassette HR recording is a suitable method of monitoring the intensity of physical activity during strenuous field conditions; (2) sustained high physical intensity is minimal in infantrymen during extended field operations; (3) this intensity of activity is adequately supported by an aerobic capacity of 50 ml o2/kg. min.; (4) the highest sustained HR is produced by marches or movements to contact; and (5) the physical fatigue and diminished sleep of combat operations may force infantrymen to perform at a slower rate regardless of operational demands as the exercise progresses.
GRA

N88-15383# Boston Univ., Mass. School of Medicine.
POLYCYTHEMIA AND HYDRATION STATUS: EFFECTS ON BLOOD VOLUME AND THERMOREGULATION DURING EXERCISE-HEAT STRESS
Michael N. Sawka, Richard R. Gonzalez, Andrew J. Young, Stephen R. Muza, and Kent B. Pandolf Jul. 1987 30 p
(Contract N00014-79-C-0168; DA Proj. 3E1-62777-A-879)
(AD-A185946; AD-F000114) Avail: NTIS HC A03/MF A01 CSCL 06J

We studied the effects of autologous erythrocyte reinfusion on blood volume and thermoregulation during exercise in the heat. Five heat-acclimated males attempted four Heat Stress Tests (HSTs): two pre- and two post-reinfusion. Autologous erythrocyte reinfusion was accomplished with 500 ml of a NaC1-glucose-phosphate solution containing about 60% hematocrit. Both pre- and post-reinfusion on a HST were done while euhydrated and one HST was done while hypohydrated (-5% of body weight). After 30 min of rest in a 20 C antechamber, the HST consisted of a 120-min exposure (2 repeats of 15 min rest and 45 min walking) in a hot (35 deg C, 45%rh) environment. The following new findings were made concerning acute polycythemia in heat-acclimated subjects: (1) the increased erythrocyte volume was associated with a small plasma volume expansion; (2) the plasma volume expansion was associated with an increased total circulating protein mass; (3) the increased total circulating protein mass defends plasma volume when hypohydrated; (4) polycythemia increased sweating rate and reduced core temperature during exercise-heat stress; and (5) this thermoregulatory advantage conferred by acute polycythemia was effective even during hypohydration.
GRA

N88-15384# Naval Health Research Center, San Diego, Calif.
COMPUTER RESPONSE TIME MEASUREMENTS OF MOOD, FATIGUE AND SYMPTOM SCALE ITEMS: IMPLICATIONS FOR SCALE RESPONSE TIME USES Interim Report

David H. Ryman, Paul Naitoh, Carl Englund, and S. G. Genser
27 Feb. 1987 26 p
(AD-A186093; NHRC-87-20) Avail: NTIS HC A03/MF A01 CSCL 05H

Response times (RT) in a series of computer-administered questionnaires were collected in two continuous operation time-shifted studies to evaluate how useful these measures might be in various research areas. These studies involved exercising and non-exercising subjects at two start-of-day times (noon, midnight). Thirty subjects were tested over two continuous workdays (CW1 and CW2) of 20 hrs each with three hr nap allowed between days. The scales analyzed were the Vigor and Fatigue Scales of the Profile of Mood States (POMS), the Kogi Sympton Checklist, the School of Aerospace Medicine (SAM) Fatigue Scale, and the Naval Health Research Center Mood Questionnaire (NHRC MQ) Negative and Positive Mood Scales. The results demonstrate the RT measurement of questionnaire scales can be used as a measure of intensity and congruence of mood, as well as indicating scale validity. RT alone was not useful for indicating hasty responders (straight liners), but subjects using a constant scale response value were significantly faster (lower RT). The POMS Fatigue scale and RT were significantly correlated on both days indicating the usefulness of RT in showing scale validity (the more fatigue, the slower the response). GRA

N88-15385# Harvard Medical School, Boston, Mass. Dept. of Physiology and Biophysics.
PHARMACOLOGICAL RESETTING OF THE CIRCADIAN SLEEP-WAKE CYCLE Annual Technical Report, 1 May 1986 - 30 Apr. 1987
Martin C. Moore-Ede 30 May 1987 6 p
(Grant AF-AFOSR-0187-86)
(AD-A186194; AFOSR-87-1360TR) Avail: NTIS HC A02/MF A01 CSCL 06O

This research project is investigating strategies to pharmacologically manipulate the circadian sleep-wake cycle in order to control the timing of alert function and of sleep in altered work schedule environments. In the past year we have investigated the benzodiazepines,diazepam (in hamsters) and triazolam (in squirrel monkeys), and have derived a phase response curve for each. In optically-enucleated hamsters, however, consistent phase shifts were not obtained suggesting that diazepam acts on light information-conveying pathways. Biochemical receptor binding studies are defining the benzodiazepine receptor density in various brain regions. In addition, the characterization of the circadian and homeostatic components of sleep in the squirrel monkey during sleep deprivation studies is being conducted in preparation for pharmacological manipulation with benzodiazepines. GRA

N88-15386# Army Research Inst. of Environmental Medicine, Natick, Mass.
LOAD CARRIAGE INDUCED ALTERATIONS OF PULMONARY FUNCTION
S. R. Muza, W. A. Latzka, Y. Epstein, and K. B. Pandolf May 1987 25 p
(AD-A186227) Avail: NTIS HC A03/MF A01 CSCL 06J

Load carriage systems supported by the trunk have been shown to decrease certain indices of pulmonary function. We investigated the hypothesis that these pulmonary function reductions are directly related to the backpack load carried due to the mechanical constraint it imposes of the thoracic cage. To investigate this hypothesis, 5 young males with no pulmonary disorders were tested while standing upright carrying well-fitted 0, 10 or 30 kg loaded U.S. Army ALICE backpacks. Forced vital capacity (FVC), forced expiratory volume (FEV1) and 15 s maximal voluntary ventilation (MVV15) were measured. With increasing load, FVC and FEV1 progressively decreased reaching 6 and 6.7 percent decrements respectively with 30 kg load. The MVV15 was decreased about 8.4 percent with the 10 kg load, but did not demonstrate any further decrement with the 30 kg load. Analysis of flow-volume loops obtained with the 0 and 30 kg loads showed that the reduction of FVC was not associated with any decrement of peak inspiratory or expiratory flows. These results indicate a limitation of the ventilatory pump caused by load carriage which is directly related to the load carried and characteristic of restrictive diseases of the respiratory system. GRA

N88-15387# California Univ., Los Angeles.
MEASUREMENT AND MODIFICATION OF SENSORIMOTOR SYSTEM FUNCTION DURING VISUAL-MOTOR PERFORMANCE Final Report, 30 Sep. 1982 - 29 Jun. 1987
M. B. Sterman, G. J. Schummer, T. W. Dushenko, and J. C. Smith 21 Aug. 1987 17 p
(Grant AF-AFOSR-0335-82)
(AD-A186351; AFOSR-87-1366TR) Avail: NTIS HC A03/MF A01 CSCL 05H

Both laboratory and in-flight studies were carried out in order to evaluate the utility and feasibility of EEG monitoring as a means of identifying central nervous system correlates of performance and G-force effects during military flight operations. Four studies were conducted, two with controlled laboratory simulation, and two in actual flight during military training missions. Data analysis focused on EEG power-spectral density characteristics and their temporal modulation, specifically in sensorimotor and visual cortical areas. Several consistent findings emerged. During competent performance, a unique discrepency appeared between left and right hemispheres in central 8-15 Hz activity. This pattern disappeared as performance degraded. The temporal modulation of this activity also reflected these changes. During high G-force situations, power at frequencies below 8 Hz was progressively and non-specifically enhanced. Continued competent performance, however, was still reflected by the pattern described above. These findings are discussed in terms of their neurophysiological implications. GRA

N88-15388# Boston Univ., Mass. School of Medicine.
DEVELOPMENT AND APPLICATIONS OF NEW TECHNICAL ADVANCES TO PROBLEMS OF FLUID/ELECTROLYTE/MINERAL IMBALANCE IN MILITARY PERSONNEL Final Report, 1 Jul. 1985 - 1 Jan. 1987
Morteza Janghorbani Apr. 1987 51 p
(Contract DAMD17-85-G-5036; DA Proj. 3E1-62777-A-879)
(AD-A186437) Avail: NTIS HC A04/MF A01 CSCL 06D

This constitutes the final report for the period 7/1/85 through 1/1/87 in the studies related to methods development for stable isotope tracers in heat research. Four segments have been described in this final report: (1) acquisition, installation, and testing of a two-analyzer system for measurement of stable isotopes, (2) development work related to stable isotopes of rubidium, (3) development of measurement aspects of stable isotopes of bromine, and (4) completion of analytical chemistry for stable isotopes of lithium. GRA

N88-15389# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 21, NO. 3, MAY - JUNE 1987
O. G. Gazenko, ed. 12 Jan. 1988 151 p Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 96 p
(JPRS-USB-88-001) Copyright Avail: NTIS HC A08/MF A01

Translations of articles from the Russian journal, Space Biology and Aerospace Medicine are presented. Typical article titles are: Trace element metabolism in man and animals in the presence of hypoxic states of diverse etiology; Cardiac contractility in weightlessness according to spatial ballistocardiography; Blood redistribution in man with lower body negative pressure; Nystagmometric distinctions of individual regularly exposed to vibration; Spleen lymphocyte nucleic acids in pregnant rats flown in space and their offspring; and Role of hemoglobin affinity for oxygen in efficiency of blood respiratory function. For individual titles, see N88-15390 through N88-15411.

N88-15390# Joint Publications Research Service, Arlington, Va.
TRACE-ELEMENT METABOLISM IN MAN AND ANIMALS IN THE PRESENCE OF HYPOXIC STATES OF DIVERSE ETIOLOGY

V. V. Nasolodin and V. Ya. Rusin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 9-18 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 10-16 (For primary document see N88-15389 07-52)

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Reported data and results obtained by the authors which describe metabolic pathways of trace elements in humans and animals during hypoxia of different origin are reviewed. Possible causes and symptoms of their defficiency are discussed and methods of restoring the balance of trace elements are presented. Author

N88-15391# Joint Publications Research Service, Arlington, Va.
PHYSIOLOGICAL AND BIOCHEMICAL ASPECTS OF TOXIC EFFECTS OF OXIDANTS IN MAN'S ENVIRONMENT (AIR, WATER)

Z. P. Pak and G. V. Lobacheva *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 19-31 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 16-23 (For primary document see N88-15389 07-52)

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A review is given of published data about physiological and biochemical aspects of the toxic effect of oxygen, ozone, hydrogen peroxide, nitrogen oxide and haloid containing disinfectants on the human body. The mechanism of action of various oxidants in terms of free radical reactions is analyzed. The oxidant sensitivity of membrane structures, sulfhydryl compounds, proteins, enzymes and the genetic apparatus of the cell is evaluated. The effect of oxidants on the function and structure of erythrocytes, red marrow, blood coagulation, immunity, histological and histochemical structure of organs and tissues is described. Author

N88-15392# Joint Publications Research Service, Arlington, Va.
SOME ASPECTS OF SOCIOPSYCHOLOGICAL SCREENING OF FLYING SCHOOL APPLICANTS **c53**

V. I. Yevdokimov and P. P. Parkhomenko *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 32-36 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 23-26 (For primary document see N88-15389 07-52)

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One hundred and fifty nine applicants who passed entrance examinations and were admitted to the flight school were kept under careful psychological observation and follow up. It was found that those applicants who grew and developed in unfavorable conditions, i.e., under the influence of risk factors which include young age to start smoking, nervous shocks in childhood and adolescence, unstable family relationships, alcoholic parents, etc., failed and were expelled from the school due to different reasons in a greater number of cases. Thus professional selection should include accentuated attention to risk factors that accompanied the years of personality formation which may help predict their inadequacies in psychic adaptation to the flying profession. Author

N88-15393# Joint Publications Research Service, Arlington, Va.
CARDIAC CONTRACTILITY IN WEIGHTLESSNESS ACCORDING TO SPATIAL BALLISTOCARDIOGRAPHY

R. M. Bayevskiy, P. S. Chattarjee, I. I. Funtova, and M. D. Zakatov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 37-44 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 26-31 (For primary document see N88-15389 07-52)

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In the joint Soviet-Indian space flight, the method of spatial ballistocardiography was used to investigate the cardiac function in flight. The piezoelectric transducer was placed between the scapulae and its orientation was varied relative to the three axes of the body. Measurements were taken twice before, twice during and twice after flight. Ballistocardiograms were analyzed in terms of their amplitude, time and spectral parameters. It was found that in microgravity the energy of cardiac contractions developed spatial redistribution. It was also demonstrated that the cardiovascular function showed individual variability. Author

N88-15394# Joint Publications Research Service, Arlington, Va.
COSMONAUTS' HORMONAL RESPONSES AFTER BRIEF SPACEFLIGHTS

R. A. Tigranyan, N. F. Kalita, T. A. Kiseleva, V. M. Ivanov, Ye. V. Kolchina, and B. V. Afonin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 45-49 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 32-35 (For primary document see N88-15389 07-52)

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After short term (7 day) space flights the following parameters were measured in blood of cosmonauts: cortisol, ACTH, aldosterone, thyrotropic hormone, thyroxine, thiiodothyronine, somatotropic hormones, insulin, testosterone, cyclic nucleotides, prostaglandins, activities of the kallikrein kinin, fibrinolytic and coagulatory systems, and plasma renin activity; in addition, renal excretion of aldosterone and total 17 oxycorticosteroids was determined. It was demonstrated that after short term flights the acute period of adaptation was accompanied by a moderate activation of the renin angiotensin aldosterone system, adrenal glucocorticoid function, pancreatic insular apparatus, kallikrein kinin system as well as increased cyclic AMP which is suggestive of a moderately expressed stress reaction. Author

N88-15395# Joint Publications Research Service, Arlington, Va.
HUMAN AND ANIMAL HYPOVOLEMIC REACTIONS TO INCREASING +Gz ACCELERATIONS

R. A. Vartbaronov, G. D. Glod, N. N. Uglova, and I. S. Rolik *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 50-55 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 35-39 (For primary document see N88-15389 07-52)

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Maximal variations of the circulating blood and plasma volumes after water load and/or exposure to increasing +Gz were investigated in manned and animal studies. The animal study demonstrated that the relative changes in the circulating blood and plasma volumes can be calculated using hematocrit or hemoglobin values. On the 2d minute after exposure to increasing +Gz of up to 14.5 G the animals showed a decrease (by 11.7 percent) of the circulating blood volume which was primarily associated with plasma losses. The change was not appreciably modified by the use of an anti-G suit. In the manned studies the decrease was 5.9 percent during exposure to 7 G and 11 percent during exposure to 9 G with an anti-G suit used. These observations show that the acceleration duration and value play an important part in the mechanism of plasma filtration in response to an increase in the hydrostatic pressure. Author

N88-15396# Joint Publications Research Service, Arlington, Va.
KARYOMETRIC EVALUATION OF NEURONAL REACTIONS OF RAT CEREBRAL CORTEX TO THE COMBINED EFFECT OF IONIZING RADIATION, LONGITUDINAL ACCELERATIONS AND VIBRATION **c51**

V. P. Fedorov and I. B. Ushakov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine,

Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 56-60 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 39-42 (For primary document see N88-15389 07-52)
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Using karyometric procedures, the reactions of neuronal nuclei of the middle layers of the sensorimotor cortex of rats exposed to the combined effect of ionizing radiation and longitudinal acceleration or vertical vibration were investigated. It was found that the size of neuronal nuclei varied depending on the radiation dose and type of combination of radiation with other exposures. Author

N88-15397# Joint Publications Research Service, Arlington, Va.
BLOOD REDISTRIBUTION IN MAN WITH LOWER BODY NEGATIVE PRESSURE
V. A. Degtyarev, M. A. Kaplan, L. Ya. Andriyako, Yu. A. Bubeyev, and Yu. I. Remizov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 61-65 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 42-45 (For primary document see N88-15389 07-52)
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During exposure to lower body negative pressure (LBNP) of -10 to -60 mm Hg variations in the blood filling of body segments were measured, using Fe-59 labelled erythrocytes. Ten healthy volunteers were exposed to six LBNP sessions (in recumbency). The data obtained were related to changes in the blood filling of various body segments which were the most pronounced at LBNP -20 to -30 mm Hg. As the LBNP level increased, the changes in the blood filling of the pelvis and legs, head and thorax decreased. In the abdominal area this parameter remained essentially unaltered. The distinct variations in the thoracic blood filling were probably dependent on the amount of blood shifted to the decompressed area which may be related not only to the venous capacity in this area but also to the venous arterial reflexes and possibly to the specific transfer of reduced pressure in tissues. Author

N88-15398# Joint Publications Research Service, Arlington, Va.
HUMAN METABOLISM AND PERIPHERAL CIRCULATION DURING ANTIORTHOSTATIC HYPOKINESIA
V. Ye. Vorobyev, I. V. Kovachevich, L. L. Stazhadze, V. F. Ivchenko, V. R. Abdrakhmanov, V. N. Kalyanova, S. G. Voronina, and L. G. Repenkova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 66-70 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 44-49 (For primary document see N88-15389 07-52)
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Metabolism and peripheral circulation were investigated in head down tilt tests of varying duration. The greatest changes were seen on test day 30, when the subjects showed venous hyperoxia, lower oxygen arterio-venous difference and a significant decrease of oxygen tension in arterial blood and oxygen utilization in tissues. At the same time the subjects exhibited an increase in Pi and lactate and a maximum growth of 2,3-diphosphoglyceric acid. This exposure seems to produce a discrepancy between oxygen supply and oxygen requirements in tissues which gives rise to secondary tissue hypoxia. It is believed that the basic cause of these changes is disordered oxygen transport from blood to tissues. Author

N88-15399# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS AND MECHANISMS OF EFFECTS OF EPINEPHRINE AND NOREPINEPHRINE ON CARDIAC PUMPING FUNCTION UNDER HYPOKINETIC CONDITIONS
A. S. Chinkin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 71-75 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 49-52 (For primary document see N88-15389 07-52)
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The effect of epinephrine (E) and norepinephrine (NE) on cardiac output (CO) and heart rate (HR) of hypokinetic and control rats was studied. It was found that in the hypokinetic animals the E effect on CO was significantly weaker than in the controls while the NE effect was stronger. In most experiments the response to NE in the hypokinetic animals was greater than that to E. The mean HR increase was significantly different in the two groups but in the hypokinetic rats the response to E was less expressed. These data give reason to believe that the lower E effect on CO in the hypokinetic animals is associated with diminished alpha-adrenergic effects on the heart. Author

N88-15400# Joint Publications Research Service, Arlington, Va.
BIORHYTHMOLOGICAL ANALYSIS OF DYNAMICS OF PULMONARY VENTILATION PARAMETERS DURING ORTHOSTATIC TESTS
V. A. Galichiy *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 76-85 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 52-59 (For primary document see N88-15389 07-52)
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Pulmonary ventilation parameters (breathing depth, frequency and minute volume, and alveolar ventilation) of 5 healthy male test subjects who performed a 20 min tilt test were analyzed. During tilt tests the above parameters showed oscillations in a range of about 1 min. During the first 1 to 3 min of exposure the parameters exhibited an accentuated synchronization of the oscillations and the phenomenon of general autonomic switch over with the negative phase. From the 4th min till the 6.5th min the function of individual components of the pulmonary ventilation system mismatched and the respiration efficacy fell. Thereafter this synchronization of the processes studied returned to normal. Adequate adaptation of pulmonary ventilation to tilting developed not earlier than during the 13 to 14 min. Author

N88-15401# Joint Publications Research Service, Arlington, Va.
NYSTAGMOMETRIC DISTINCTIONS OF INDIVIDUALS REGULARLY EXPOSED TO VIBRATION
T. A. Nalimova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 86-91 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 59-62 (For primary document see N88-15389 07-52)
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Workers regularly exposed to vibration whose work record was not less than 10 years were examined. Nystagmometric data derived from caloric and optokinetic tests performed before and after work shifts were analyzed. The amount of atypical reactions was the greatest in the caloric and optokinetic tests carried out before work shifts. This was suggestive of the trend toward normalization discerned in the afternoon reactions. The phenomenon of normalization can be added to the list of objective symptoms that are typical of vibration sickness. Author

N88-15402# Joint Publications Research Service, Arlington, Va.
MOTHER-FETUS SYSTEM AS OBJECT FOR INVESTIGATION OF MECHANISMS OF PHYSIOLOGICAL EFFECT OF WEIGHTLESSNESS
L. V. Serova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 92-97 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 63-66 (For primary document see N88-15389 07-52)
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The place of embryological investigations in the program of mammalian experiments onboard the Cosmos biosatellites is

discussed. The mother fetus system is viewed as a specific loading test for studying the reserve potentials of the mammalian body in microgravity. It was demonstrated that mammalians (Wistar rats) flown during the third term of their pregnancy can maintain homeostasis of the developing fetus within the limits that provide the normal development of physiological functions. Significant individual variations in animal responses to microgravity were also found. Author

N88-15403# Joint Publications Research Service, Arlington, Va.
SPLEEN LYMPHOCYTE NUCLEIC ACIDS IN PREGNANT RATS FLOWN IN SPACE AND THEIR OFFSPRING c51
G. S. Komolova, V. F. Makeyeva, I. A. Yegorov, and L. V. Serova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 98-101 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 66-69 (For primary document see N88-15389 07-52)
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The spaceflight effect on the synthesis of nucleic acids in spleen lymphocytes in pregnant rats and their offspring was investigated. In addition to the inhibition of the DNA replicative function previously detected in males, activation of RNA synthesis was seen in the pregnant females. Such changes did not develop in the synchronous mock up controls. The 30 day and 100 day old pups of the rats flown in space during the last third of their pregnancy showed no changes in the DNA replicative function. The 100 day old animals displayed only a slight, when compared to the vivarium controls, decline of RNA synthesis which was produced by concomitant factors rather than by microgravity per se. It is supposed that microgravity induced activation of RNA synthesis in spleen lymphocytes of pregnant rats is associated with the involvement of these cells in adaptive trophic processes that are to maintain plastic homeostasis of the fetus in an unusual environment. Author

N88-15404# Joint Publications Research Service, Arlington, Va.
DISTINCTIVE CHANGES IN ARTERIAL PRESSURE AND BLOOD FLOW IN COMMON CAROTID ARTERY OF MONKEYS FLOWN ABOARD COSMOS-1514 BIOSATELLITE c51
V. P. Krotov, H. Sandler, A. M. Badakva, J. Hines, V. S. Magedov, and H. Stone *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 102-108 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 69-74 (For primary document see N88-15389 07-52)
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Preflight, the rhesus monkey, Bion, was implanted with sensors and transducers to measure blood pressure and linear flow velocity in the common carotid artery and to compare these parameters with central circulation. At the early flight stage blood pressure increased, blood flow decreased and resistance in the area grew. The last change can be regarded as a compensatory reaction that can provide rapid adaptation of regional circulation to changes in systemic circulation. At later flight stages blood pressure showed distinct circadian oscillations and blood flow, a significant increase when compared to the ground based 36 hour control study. Regulatory mechanisms of the cardiovascular system changed to the greatest extent on flight day 2. This manifested as a decrease of the amplitude of circadian oscillations of the above circulation parameters. Signs of cardiovascular adaptation to the effects of microgravity were discerned on flight days 3 to 5. Author

N88-15405# Joint Publications Research Service, Arlington, Va.
BIOFEEDBACK CONTROL OF ALVEOLAR CARBON DIOXIDE TENSION TO ELIMINATE HYPOCAPNIA IN MAN IN THE PRESENCE OF HYPOXIA
I. S. Breslav, A. M. Shmeleva, and A. T. Normatov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 109-113 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 74-77 (For primary document see N88-15389 07-52)
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Reactions of the respiratory system to the inhalation of a hypoxic gas mixture were compared when the test subjects practiced normal breathing or breathing with a stable alveolar carbon dioxide tension. In the latter case, the test subjects controlled their lung ventilation using the biofeedback technique. In this manner hyperventilation and related hypocapnia were eliminated. The possibility of practical application of biofeedback to the control of man's respiration in situations that may cause hypocapnia is discussed. Author

N88-15406# Joint Publications Research Service, Arlington, Va.
ROLE OF HEMOGLOBIN AFFINITY FOR OXYGEN IN EFFICIENCY OF BLOOD RESPIRATORY FUNCTION
K. P. Ivanov, A. Ye. Chuykin, G. V. Samsonov, and N. P. Kuznetsova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 114-117 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 77-80 (For primary document see N88-15389 07-52)
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In acute experiments the oxygen transport properties of two solutions of modified stroma purified hemoglobin were investigated using anesthetized Wistar rats. The solutions were: (1) Hb = 8.0 g per 100 g, P sub 50 = 12.5 mm Hg; and (2) Hb = 4.4 g per 100 g, P sub 50 - 21.5 mm Hg. The solutions were used in stage by stage isovolumic substitution in rats of two groups. The modified hemoglobin solution with a lower hemoglobin oxygen affinity was found to be a more efficient blood substitute. In spite of its low oxygen capacity, it could sustain life activity at very low hematocrit values. When the oxygen capacity of blood is moderate or low, hemoglobin oxygen affinity plays a very important part in oxygen supply to different tissues, specifically to the heart. The latter determines the crucial compensatory physiological reaction to acute anemia, i.e., increase of cardiac output. Author

N88-15407# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFECT OF SILVER COMPOUNDS ON MICROFLORA IN WATER RECLAIMED FROM ATMOSPHERIC MOISTURE CONDENSATE IN A CLOSED ENVIRONMENT c54
M. I. Shikina, Yu. Ye. Sinyak, S. V. Chizhov, and N. B. Kolesina *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 118-121 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 80-82 (For primary document see N88-15389 07-52)
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The effect of different silver compound on microorganisms in water reclaimed from the atmospheric condensate in an enclosed environment was investigated. The following microorganisms were examined: Alcaligenes faecalis, Citrobacter freundii, Aeromonas hydrophylla, Staphylococcus epidermitis, etc. The ionic silver concentrations in solution varied from 0.1 to 10 mg/l. The efficiency of the silver compounds was found to depend on the microbial strain, ionic silver concentration in solution and time of exposure. The microflora of the reclaimed water proved to be highly resistant to the preservatives which was strongly associated with the bacterial, physical and chemical composition of the products preserved. Author

N88-15408# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF METHODS FOR THE STUDY OF SPACE MOTION SICKNESS
A. D. Matveyev *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 122-132 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p

83-88 (For primary document see N88-15389 07-52)
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Current theory on the pathogenesis of space motion sickness (SMS) served as the basis to develop methods for studying and preventing SMS: intralabyrinthine and interanalyzer conflict, onset in weightlessness of disturbances referable to dynamics of spinal fluid, as well as the authors own conception that development of circulatory static venous ischemia and hypoxia of the brain is the cause of SMS. The methods and instruments are described that were developed, and the results are submitted of inflight and ground based studies of vestibular function and SMS conducted by the author over a 20 year period. Author

N88-15409# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF ENERGY METABOLISM OF BIOLOGICAL SYSTEMS IN WEIGHTLESSNESS
M. G. Tairbekov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 133-134 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 89-90 (For primary document see N88-15389 07-52)
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On the basis of analysis of data in the literature and results of inhouse studies, it could be assumed that there should be less than normal energy expenditure by biological systems (in particular, cells) in weightlessness. Such a decline in expended energy could be expected primarily due to diminished energy used to maintain mechanical strength of the system. The dynamics and intensity of energy metabolism in microgravity was examined. It was concluded that conditions associated with weightlessness does not affect the level of basal energy metabolism in plants and insects when using the energy of chemical bonds for division, growth and differentiation of cells. Author

N88-15410# Joint Publications Research Service, Arlington, Va.
DIFFERENTIATION OF HEMOPOIETIC STEM CELLS DURING ADAPTATION TO HIGH ALTITUDE
O. I. Andreyeva, V. V. Pukhov, and S. B. Daniyarov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 135-137 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 90-91 (For primary document see N88-15389 07-52)
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It is known that exposure of a biological system to a hypoxic environment leads to stimulation of erythropoiesis and increase in number of red cells in peripheral blood. At the same time, no studies have been made of the distinction of differentiation of hemopoietic stem cells (HSC) during the period of adaptation to high altitude. Nor is there clarity as to the level on which mountain hypoxia alters the direction of differentiation. The distinctions of HSC differentiation during the period of adaptation to high altitude was investigated. Method and results are discussed. Author

N88-15411# Joint Publications Research Service, Arlington, Va.
THIRD SOVIET-FRENCH SYMPOSIUM ON SPACE CYTOLOGY c51
I. B. Krasnov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 138-143 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 92-95 Symposium held in Reims, France, 4-11 May 1986 (For primary document see N88-15389 07-52)
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The Third Soviet-French Symposium on Space Cytology, which was organized within the framework of collaboration in the area of medicine and medical technology between the USSR Ministry of Health and French National Institute of Health and Medical Research, convened from 4 to 11 May, 1986 in France. Space cytology is a discipline that studies the effect of spaceflight factors such as weightlessness, high energy particles, etc., on the structure, function and metabolism of prokaryote and eykaryote cells of bacteria, plants, and animals. Some titles of meetings are: Nerve cells, Lymphocytes and cells in tissue cultures, Bone tissue, Erythrocytes, Analytical methods, and Biological models. E.R.

N88-15412# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 21, NO. 4, JULY - AUGUST 1987
O. G. Gazenko, ed. 13 Jan. 1988 158 p Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 96 p
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Topics addressed in space biology and aerospace medicine include: effects of microwaves ionizing radiation; cosmos-1667 experiments; rat brain morphogenesis in weightlessness; circulatory response to antiorthostatic hypokinesia; effects on skeletal muscles during hypokinesia; hemodynamics; physiological effects; immunological effects; hypoxia; ecology; aviation psychology; hypercapnia; respiratory responses. For individual titles, see N88-15413 through N88-15435.

N88-15413# Joint Publications Research Service, Arlington, Va.
COMBINED EFFECT OF MICROWAVES AND IONIZING RADIATION
Yu. G. Grigoryev, V. S. Stepanov, G. V. Batanov, L. I. Beskhlebnova, Z. Ya. Mityayeva, A. A. Paramonov, and R. M. Salimov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 1-7 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21. no. 4, Jul. - Aug. 1987 p 4-9 (For primary document see N88-15412 07-52)
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The response of different physiological systems to ionizing radiation as modified by UHF radiation of nonthermal intensity was investigated. The experimental rats were exposed to electromagnetic irradiation of the power flux density (PFD) 200 microW/sq cm 30 minutes daily for 8 days and the next day they were exposed to single total-body gamma-irradiation at a dose of 5.5 Gy. Pre-exposure to UHF irradiation reduced 1.5 times the mortality rate of the test animals as compared to the controls. Immunobiological examinations revealed a significant increase of the stimulation index in the mitogen (PHA) induced lymphocyte blast-transformation reaction and a decrease of the autopatch count. The motor activity of the rats exposed for 20 minutes to gamma-irradiation at a dose of 0.34 Gy and the next day to UHF irradiation (PHA = 40 microW/sq cm) for 1 and 5 minutes remained essentially unchanged. The imprinting of the chicks irradiated in early embryogenesis for 5 minutes with UHF (PHA = 40 microW/sq cm) and then with gamma-rays at a dose of 0.36 Gy was disrupted. Author

N88-15414# Joint Publications Research Service, Arlington, Va.
EXPERIMENTS WITH RATS FLOWN ABOARD COSMOS-1667 BIOSATELLITE (MAIN OBJECTIVES, CONDITIONS AND RESULTS) c51
O. G. Gazenko, Ye. A. Ilyin, Ye. A. Savina, L. V. Serova, A. S. Kaplanskiy, V. S. Oganov, I. A. Popova, K. V. Smirnov, and I. V. Konstantinova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 8-16 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 9-16 (For primary document see N88-15412 07-52)
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Morphobiochemical investigation of the rats flown on the biosatellite Cosmos-1667 have shown that the 7 day spaceflight produces shifts in different systems, organs, and tissues which reflect adaptive processes to microgravity. Early signs of structural, functional, and metabolic rearrangement can be detected in the musculoskeletal apparatus, hemopoietic system, lymphoid organs,

and neurohormonal systems, i.e., in the systems and organs that develop changes during long term flights. The rates of adaptation to microgravity are different not only in various systems and organs but also within the same tissues. Most shifts that emerge at an early stage of adaptation to microgravity progress with flight time but some of them develop to a full extent after the 7 day flight. The specific feature of the early stage of adaptation to microgravity is the lack of significant changes in tissues. The fact gives evidence that the mechanisms maintaining homeostasis at the organism level are not as yet disrupted during 7 days of flight. Author

N88-15415# Joint Publications Research Service, Arlington, Va.
BRAIN MORPHOGENESIS IN RATS DEVELOPING IN WEIGHTLESSNESS **c51**
I. B. Krasnov, S. N. Olenev, I. I. Babichenko, and V. S. Kesarev *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 17-24 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 16-22 (For primary document see N88-15412 07-52)
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Macroscopic and light microscopic examination of the brain of 18 day fetuses, and neonate 15, 30, and 100 day rats whose embryonic development from day 13 to day 18 occurred in spaceflight on Cosmos-1514 did not reveal any changes in the brain structures of the fetuses or pups of the three ages. However, the brain of the 18 day fetuses that developed in flight showed signs of insufficient tissue oxygenation, trends toward delayed cell migration in the cortex and delayed differentiation of neurosecretory cells of the hypothalamic supraoptic nuclei. The cell differentiation rate returned to normal during continued embryogenesis after flight at 1 G. Author

N88-15416# Joint Publications Research Service, Arlington, Va.
CIRCULATORY RESPONSE OF MALES 45-52 YEARS OF AGE TO ANTIORTHOSTATIC HYPOKINESIA
V. I. Sokolov, Kh. Kh. Yarullin, N. D. Vikharev, M. V. Sazonova, and N. V. Degterenkova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 25-31 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 22-26 (For primary document see N88-15412 07-52)
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Regional and central circulation reactions to 30 day antiorthostatic hypokinesia were investigated in 15 men, ages 45 to 52 years, with early signs of cerebrovascular and aortic atherosclerosis, neurocirculatory dystonia of the hypertensive type, and hypertensive disease of stage 1. Regional and central hemodynamics of the subjects of the three groups during and immediately after exposure developed in a different manner. Author

N88-15417# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC ANALYSIS OF RAT AORTA ENDOTHELIUM DURING LONG-TERM HYPOKINESIA **c51**
A. N. Gansburgskiy *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 32-35 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 26-28 (For primary document see N88-15412 07-52)
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Twenty-four white rats were exposed to 30, 60, and 100 day hypokinesia. Using the stereological technique, film preparation of their aortic endothelium were examined for the mean areas of endothelial cells, nuclei, and cytoplasm. Also, the content of endothelial cells showing karyopyknosis, karyolysis, or binuclear structures was measured morphometrically. As compared to the matched control, the numbers of cells with karyopyknosis, karyolysis, and two nuclei increased significantly at every time interval studied. On hypokinesia day 30, the area of endothelial cell, nuclei, and cytoplasm was greater than that of the controls. On hypokinesia days 60 and 100, the cell size was within normal limits and the nuclear size was smaller. This led to a decrease of the nucleus-plasma ratios. Together with other factors responsible for hypercholesterinemia, the above changes in the endothelial layer may facilitate atherosclerotic lesions of the vascular wall during prolonged hypokinesia. Author

N88-15418# Joint Publications Research Service, Arlington, Va.
NUCLEIC ACID CONTENT OF SKELETAL MUSCLES DURING HYPOKINESIA AND IN THE RECOVERY PERIOD **c51**
D. Z. Shibkova and N. A. Fomin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 36-40 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 28-31 (For primary document see N88-15412 07-52)
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The concentration of nucleic acids in the gastrocnemius muscle of Wistar rats was measured during 60 day hypokinesia and 30 day recovery periods. The data obtained indicated that this hypokinesia model leads to an arrest of muscle growth and inhibition of the age-related accumulation of nucleic acids in the gastrocnemius muscle. The content of DNA and RNA genetic matrices largely depends on the muscle activity. Normalization of the motor function results in an activation of genetic mechanisms of biosynthesis regulation, acceleration of reparative processes, and recovery of muscular activity. Author

N88-15419# Joint Publications Research Service, Arlington, Va.
ROLE OF TESTING TOTAL GAS (O2 AND CO2) TENSION OF BLOOD PLASMA IN THE STUDY OF HUMAN GAS HOMEOSTASIS
G. Ya. Gebel, V. A. Degtyarev, V. N. Dasayev, V. N. Utkin, A. G. Kruglov, V. V. Gudenko, and A. A. Lilloson *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 41-55 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 31-41 (For primary document see N88-15412 07-52)
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Sixty essentially healthy subjects were examined manometrically with blood withdrawn from the coronary sinus, pulmonary artery, aorta, veins of the right kidney and the right liver lobe. Together with the traditional parameters of the gas contents and gradients of plasma, it is proposed to use tests measuring additive O2 and CO2 parameters. It was demonstrated that the above organs can be discriminated using tests that are additive with respect to the gas pressure. It is emphasized that the tests proposed here, when used in addition to the traditional ones, allow identification of the gas and nongas parameters of homeostasis as a single system of tests to assess the human body function. Author

N88-15420# Joint Publications Research Service, Arlington, Va.
ACID-BASE EQUILIBRIUM AND SOME RAT BLOOD PARAMETERS FOLLOWING EXPOSURE TO HYPERBARIC OXYGENATION **c51**
V. V. Gladilov and N. A. Moyseyenko *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 56-61 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 41-45 (For primary document see N88-15412 07-52)
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Acid-base equilibrium, glycolytic parameters, electrophoretic mobility, and hemoglobin oxygen affinity in the blood of rats exposed to hyperbaric oxygenation were measured. The animals were kept at 2026 kPa for 15, 30, or 60 minutes. It was found that the short-term oxygenation led to changes in acid-base

equilibrium, then to biochemical changes in plasma and erythrocytes and, consequently, to a higher oxygen-binding ability of hemoglobin. The increased hemoglobin oxygen affinity was significantly stable and persisted for a certain period of time in the normal atmosphere. The experimental data demonstrated that most blood parameters taken under study varied in a different manner, depending on the time during which the animals were exposed to oxygen. Author

N88-15421# Joint Publications Research Service, Arlington, Va.
CHANGES IN REGIONAL AND CENTRAL HEMODYNAMICS DURING SEVEN-DAY WATER IMMERSION
Kh. Kh. Yarullin, L. G. Simonov, and S. A. Vtoryy *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 62-69 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 45-50 (For primary document see N88-15412 07-52)
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Regional and central hemodynamics were assessed at bi- and tetrapolar rheography and tachooscillography during 7 day dry immersion and 8 day head-down tilt. Blood redistribution evident from enhanced pulse filling of the brain, lungs, and arms was the most pronounced on day 3 to 5. The onset of the blood outflow to the liver was observed on immersion day 5 due to compensatory and adaptive reactions. Lack of exercise tolerance of cardiovascular system through its insufficient training was similar in the immersion and head-down tilt for all the 6 healthy males studied (aged 41 to 49) despite more obvious changes in regional hemodynamics during the immersion, which recovered of its fifth day. Author

N88-15422# Joint Publications Research Service, Arlington, Va.
SPECIFIC ORGANIC COMPOUNDS IN EXCRETA
M. T. Dmitriyev, A. G. Malysheva, and Ye. G. Rastyannikov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 70-78 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 50-56 (For primary document see N88-15412 07-52)
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Chromato-mass-spectrometry was used to examine human wastes for the first time. The data on the excretion rate of specific organic compounds can be employed to predict the content of toxic metabolites in the enclosed environment, to give their biomedical characterization, and to diagnose unfavorable changes in the body. Author

N88-15423# Joint Publications Research Service, Arlington, Va.
CHANGES IN FUNCTIONAL PARAMETERS OF ANIMALS DURING LONG-TERM INHALATION OF ACETIC ACID **c51**
V. P. Savina and B. V. Anisimov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 79-84 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 56-60 (For primary document see N88-15412 07-52)
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Laboratory animals inhaled acetic acid vapors at a concentration of 86 to 27 mg/cu m for 3 to 35 days. It was found that the dose of 36 mg/cu m inhaled for as long as 22 days constituted the minimal acting dose. The most sensitive parameters to be used in detecting the toxic effect of acetic acid were: treadmill run duration, open field activity, and ethylene, acetaldehyde and acetone concentrations in the exhaled air. Author

N88-15424# Joint Publications Research Service, Arlington, Va.
PHYSIOLOGICAL AND IMMUNOLOGICAL ASPECTS OF HUMAN ADAPTATION TO TEMPERATURE ELEVATION IN A CLOSED ENVIRONMENT
L. N. Mukhamediyeva, I. V. Konstantinova, V. V. Zhuravlev, Ye. N. Antropova, G. P. Teplinskaya, and Ye. I. Nikitin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 85-90 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 60-64 (For primary document see N88-15412 07-52)
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Physiological and immunological investigations have shown that on day 2 of adaptation to the warming enclosed environment the test subjects may develop pustular skin disease. A certain role in the disease is played by the autoinfection process aggravated by sensitization of the organism to autoantigens. Author

N88-15425# Joint Publications Research Service, Arlington, Va.
EFFECT OF PYROCETAM ON MOUSE RESISTANCE TO HYPOXIC HYPOXIA 2-3 MONTHS AFTER EXPOSURE TO X-RADIATION **c51**
A. V. Popov, A. A. Bochenkov, Yu. Yu. Ivnitskiy, and Yu. V. Volkovskiy *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 91-95 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 64-66 (For primary document see N88-15412 07-52)
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The resistance of mice to hypoxic hypoxia 3 months after their X-irradiation was evaluated with respect to such parameters as survival rate during the ascent to 11,000 m, life time at that altitude, and brain succinic dehydrogenase (SDH) and lactate dehydrogenase (LDH) activities at an altitude of 7000 m. Irradiated mice proved to be less resistant to hypoxic hypoxia. The SDH activity increased to a greater extent in nonirradiated than in irradiated animals. Pyracetam increased significantly the resistance of hypoxia of both irradiated and nonirradiated mice. The SDH activity was stimulated by hypoxia in a greater degree in the pyracetam-treated mice. The resistance to hypoxic hypoxia and SDH activation at an altitude of 7000 m were found to be closely related. The LDH activity remained essentially unchanged in any of the animal groups. Author

N88-15426# Joint Publications Research Service, Arlington, Va.
DIAGNOSTIC VALUE OF SOME LOAD TESTS IN EVALUATION OF NONSPECIFIC ELECTROCARDIOGRAPHIC CHANGES
V. M. Kondrakov, V. I. Koledenok, P. M. Suvorov, and L. I. Arsenyeva *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 96-100 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 67-69 (For primary document see N88-15412 07-52)
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The examinations of 353 patients with various cardiovascular pathologies and changes in the end-portion of the ECG ventricular complex are described. For that purpose potassium chloride, obsidan, orthostatic, and hyperventilation tests were used. The examinations demonstrated that the ECG changes were of functional nature in 178 patients, of organic nature in 155 patients, and of mixed nature in 20 patients which was important for reliable diagnostic and expertise conclusions. Author

N88-15427# Joint Publications Research Service, Arlington, Va.
USE OF BIFIDUMBACTERIN FOR CORRECTION OF INTESTINAL DYSBACTERIOSIS
N. N. Lizko and G. I. Goncharova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 101-104 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 70-72 (For primary document see N88-15412 07-52)
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The prospect of long-term manned spaceflights advances a number of problems for space biology and medicine, among which ecology of microorganisms and interaction of the macroorganism with its autoflora acquires importance. The effects of adverse environmental factors and stress are examined. The importance of the role of bifidoflora in maintaining a normal microbiocenosis in the intestine is briefly summarized. Development of a lactate product using a strain of bifidobacteria that sours milk was another aspect of the investigations. This product was tested on healthy adults. B.G.

N88-15428# Joint Publications Research Service, Arlington, Va.
REGULATION OF ENERGY METABOLISM DURING PARACHUTE JUMPS
M. M. Dyakonov and V. R. Persianova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 105-107 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 72-73 (For primary document see N88-15412 07-52)
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Virtually all people who make parachute jumps, regardless of how long they trained for them and the number of jumps, display considerable nervous and emotional tension. The nervous and psychological tension before jumps increases the utilization of energy. The bioenergetic processes that take place at the time of making parachute jumps was investigated. The findings enabled a deeper evaluation of the changes in energy metabolism that occurs during the parachute jump and the subsequent activity. It is deemed desirable to have a rather high amount of readily assimilated carbohydrates in the diet on days when jumps are to be made and the preceding days. At the same time, it is not desirable to postpone meals for too long in the period that follows the jump. Author

N88-15429# Joint Publications Research Service, Arlington, Va.
SIMULATION OF EFFECT ON BIOLOGICAL SYSTEMS OF IMPACT WAVE FROM HEAVY CHARGED PARTICLE TRACK
Ye. Ye. Kovalev, O. D. Brill, L. V. Nevzgodina, L. I. Ivanov, and V. A. Yanushkevich *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 108-113 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 73-76 (For primary document see N88-15412 07-52)
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A flat impact wave generated upon absorption of a 50 ns laser pulse, with an energy of 10 to 15 J, in a thin opaque layer of black enamel about 1 sq cm in area, was used to obtain stable and controlled conditions of delivering radiation to the biological systems. Air-dried Lactuca sativa lettuce seeds, with relative moisture content of 6 percent, and swollen seeds were exposed. Immediately after irradiation, the seeds were allowed to germinate. The seeds were irradiated at several amplitude of impact wave-pressure in the range of several hundred to 13,000 atm. The impact wave has a noticeable effect on survival and delayed germination of dry seeds at pressures of only 200 to 300 atm. The impact wave also suppressed cell division effectively at 800 atm pressure. There were no chromosomal aberrations. B.G.

N88-15430# Joint Publications Research Service, Arlington, Va.
EFFECT OF STEROID HORMONES ON BIOGENIC AMINE LEVELS IN LUNGS DURING DEVELOPMENT OF PULMONARY HYPERTENSION IN RATS SUBMITTED TO CHRONIC HYPOBARIC HYPOXIA **c51**
N. N. Pribylova *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 114-117 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 76-78 (For primary document see N88-15412 07-52)
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At the present, it is known that the lungs are involved in biosynthesis of phospholipids, conversion of angiotensin 1 to angiotensin 2, metabolism of histamine, acetylcholine, kinins, prostaglandins, heparin, serotonin, catecholamines, and vasoactive polypeptides. Considering the close relationship between metabolism of steroid hormones and their effect on activity of biogenic amines, the task of testing the effect of steroid hormones on the levels of the most important vasopressor amines in lung tissue, in the presence of chronic hypobaric hypoxia, was undertaken. Author

N88-15431# Joint Publications Research Service, Arlington, Va.
EFFECT OF INTERMITTENT HYPERCAPNIA ON VISUAL ANALYZER FUNCTION
T. I. Golubeva and M. P. Kuzmin *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 118-120 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 78-80 (For primary document see N88-15412 07-52)
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The objective was to determine th response of man to increasing concentration of CO_2 during long-term exposure to moderate hypercapnia. Heretofore, attention was devoted mainly to the cardiorespiratory system and acid-base equilibrium in studies of man's adaptive reactions to high concentrations of CO_2. Yet all of the body's adaptive responses to environmental factors are coordinated with the function of the nervous system, while its functional state directly determines human work capacity under such conditions. It is known that dark adaptation reflects not only processes occurring in the receptor proper, but are closely related to the optical centers of the cerebral cortex, and for this reason it can determine their functional state to some extent. The study of dark adaptation of the eyes were used as an indicator of the human body response to intermittent hypercapnia. Author

N88-15432# Joint Publications Research Service, Arlington, Va.
MONONUCLEAR PHAGOCYTES DURING ADAPTATION OF ESSENTIALLY HEALTHY PEOPLE TO HIGH ALTITUDES
M. I. Kitayev and A. G. Goncharov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 121-125 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 80-82 (For primary document see N88-15412 07-52)
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The mononuclear phagocyte system (MPS) of essentially healthy people was not discussed in literature as it pertains to adaptations to alpine regions. Yet, these cells perform important functions in the body. The cells are involved in granulopoiesis, synthesis of biologically active substances and regulation of the immune response at all of its stages. It can be assumed that the MPS is involved in maintaining immunological homeostasis in naturally occurring hypoxic environments. The object was to investigate the functional distances of blood monocytes during man's adaptation to the altitude of the Pamir region. Author

N88-15433# Joint Publications Research Service, Arlington, Va.
NEW US BOOK ON AVIATION PSYCHOLOGY REVIEWED **c53**
A. A. Gyurdzhian, V. F. Tokarev, and Yu. Yu. Shipkov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 126-137 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 82-88 (For primary document see N88-15412 07-52)
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The history of aviation psychology in the U.S., basic concepts of aviation psychology, directions, and prospects of its development are covered. The professional performance of a pilot is submitted

to psychological analysis. The main guidelines of engineering psychology and its application to the design of information display systems and controls are discussed. Perceptual phenomena of flight work is examined. Individual tendencies and abilities of flight personnel, their work capacity and quality of performance are evaluated. Different aspects of pilot training are discussed. The advantages of using the systems method to organize air traffic control, conduct research with optimum and mutually complementary distribution of functions among man and machine are discussed. Finally, the methodology of research in aviation psychology, starting with the onset of some problem to practical introduction and the theoretical generalization are discussed. B.G.

N88-15434# Joint Publications Research Service, Arlington, Va.
NEW BOOK ON SPACE ECOLOGY REVIEWED c54
V. P. Pishak *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 138-140 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 88-89 (For primary document see N88-15412 07-52)
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The effect of space on Earth ecological systems and wise environmental protection are described. Topics addressed include: solar activity (electromagnetic and corpuscular radiation, solar activity and geophysical perturbations); effect of space factors on processes occurring in the biosphere; the ecological role of physical factors that depend on solar activity; experimental analysis of the biological effect of weak electromagnetic fields of ultralow frequencies; and solar activity and biological rhythms. B.G.

N88-15435# Joint Publications Research Service, Arlington, Va.
BIBLIOGRAPHY OF SPACE BIOLOGY AND MEDICINE
I. T. Akulinichev and A. A. Shipov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 141-143 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 89-90 (For primary document see N88-15412 07-52)
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The space biology and medicine bibliography lists about 10,000 references published in the period 1971 to 1975. The bibliography offers the opportunity to make a scientific analysis of publications and assess the status of different directions of the discipline, intensity of publications, basic trends in development and emerging growth points of interest for future planning of scientific research. B.G.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N88-15436# Navy Personnel Research and Development Center, San Diego, Calif.
EVOKED BRAIN ACTIVITY AND PERSONNEL PERFORMANCE Technical Report, FY86 - FY87
Gregory W. Lewis and Richard C. Sorenson Oct. 1987 42 p
(AD-A185922; AD-F000114; NPRDC-TR-88-1) Avail: NTIS HC A03/MF A01 CSCL 05H

Prior research has suggested that brain recordings such as the neuroelectric evoked potential (EP) and neuromagnetic fields may substantially augment personnel assessment procedures. Such procedures include the measurement and prediction of on-job performance. Areas covered in this report include a discussion of individual difference measurement and its history, followed by a description of evidence for the relationship between neuroelectric recordings and aptitude. Emphasis is given to relationships between EP recording and on-job performance assessment that this Center found over the last 12 years. Finally, a discussion follows of new techniques that we and others are examining and developing to improve the sensitivity of brain function measures, using the neuromagnetic evoked field (EF). Relationships between the EF and on-job performance are described. GRA

N88-15437# Minnesota Univ., Minneapolis. Dept. of Psychology.
COMPUTING SUPPORT FOR BASIC RESEARCH IN PERCEPTION AND COGNITION Interim Report, 31 Jul. 1986 - 31 Jul. 1987
Charles R. Fletcher, Gordon E. Legge, Mary J. Nissen, and Neal F. Viemeister 31 Aug. 1987 24 p
(Grant AF-AFOSR-0280-86)
(AD-A186192; AFOSR-87-1312TR) Avail: NTIS HC A03/MF A01 CSCL 05H

This report describes the progress made during the first year of an equipment grant which has provided a common computing environment for four laboratories conducting research in perception and cognition at the University of Minnesota. Research in the Cognitive Psychology Laboratory has shown that learning a procedural skill can occur in the absence of any declarative learning. Progress has also been made toward developing a computer simulation of this process. In the Visual Psychophysics Laboratory several image-enhancement algorithms have been developed as well as a psychophysical procedure for evaluating those algorithms. Research in the Auditory Psychophysics Laboratory has concentrated on developing a model of the detection and recognition of complex auditory signals by human observers. A subset of the model has been implemented as a computer simulation and several experiments have been completed to guide its future direction. In the Psycholinguistics Laboratory a computer model of text comprehension and recall has been constructed. Several experiments have been completed that confirm assumptions built into the model and show a good correspondence between its performance and that of human subjects. GRA

N88-15438# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
ROLES OF KNOWLEDGE IN MOTOR LEARNING Ph.D. Thesis
Christopher G. Atkeson 2 Feb. 1987 158 p
(Contracts N00014-82-K-0334; N00014-85-K-0124)
(AD-A186420; AI-TR-942) Avail: NTIS HC A08/MF A01 CSCL 05I

This thesis applies the computational approach to motor learning. It describes the constraints that enable performance improvement with experience, the constraints that must be satisfied by a motor learning system, what is being computed in order to achieve learning, and why it is being computed. The particular tasks used to access motor learning are loaded and unloaded free arm movement, and the thesis includes work on rigid body load estimation, arm model estimation, optimal filtering for model parameter estimation and trajectory learning from practice. Learning algorithms were developed and implemented in the context of robot arm control. Some of the roles of knowledge in learning are demonstrated. Powerful generalizations can be made on the basis of knowledge of system structure, as is demonstrated in the load and arm model estimation algorithms. Improving the performance of parameter estimation algorithms used in learning involves knowledge of the measurement noise characteristics, as is shown in the derivation of optimal filters. Using trajectory errors to correct commands requires knowledge of how command errors are transformed into performance errors, i.e., an accurate model of the dynamics of the controlled system, as is demonstrated in the trajectory learning work. GRA

N88-15439# Katholieke Universiteit, Nijmegen (Netherlands). Psychologisch Lab.
LOCAL VERSUS GLOBAL MINIMA IN VISUAL PATTERN COMPLETION
F. Boselie 1986 84 p

(PB87-234803; R-86-FU-08) Avail: NTIS HC A05/MF A01 CSCL 05I

The phenomenon of visual completion poses two problems: (1) when will a subject see one figure in front of another in contrast to several nonoverlapping figures in the same plane? and (2) exactly what will be seen behind the occluding figure? Recently, Buffart et al. (1981, 1983) argued that both questions can be answered by coding theory. Coding theory consists of the idea that a global minimum principle is operative in perception and that perception will result in an interpretation which can be represented by a code with minimal information load. Contrary to this view, it is claimed here that only those completion- and mosaic-interpretations which exploit the local advantage of continuity of sides behind occluding surfaces or avoid the local disadvantage of describing an angle on a common contour twice, will be perceptually salient. When both a locally simple completion- and a locally simple mosaic-interpretation can be made, preference will be strongest for the type of interpretation which is globally more simple. GRA

N88-15392# Joint Publications Research Service, Arlington, Va.
SOME ASPECTS OF SOCIOPSYCHOLOGICAL SCREENING OF FLYING SCHOOL APPLICANTS
V. I. Yevdokimov and P. P. Parkhomenko *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 32-36 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 23-26 (For primary document see N88-15389 07-52)
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N88-15433# Joint Publications Research Service, Arlington, Va.
NEW US BOOK ON AVIATION PSYCHOLOGY REVIEWED
A. A. Gyurdzhian, V. F. Tokarev, and Yu. Yu. Shipkov *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 126-137 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 82-88 (For primary document see N88-15412 07-52)
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54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N88-15440# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
RESOURCES, CONFUSIONS AND COMPATIBILITY IN DUAL AXIS TRACKING: DISPLAYS, CONTROLS AND DYNAMICS Ph.D. Thesis
Martin L. Fracker 1987 137 p
(AD-A185871; AFIT/CI/NR-87-105T) Avail: NTIS HC A07/MF A01 CSCL 05H

Dual axis compensatory tracking was investigated as a function of whether error displays were integrated or separated, whether axis controls were integrated into one stick or remained separate, and whether the control dynamics on the two axes were the same or different. Tracking error increased and control activity decreased as a function of the summed difficulty of the two control dynamics. Integrated displays and integrated controls both led to increased confusions between tracking axes although error was unaffected. Importantly, performance was also affected by whether the integrality of displays matched that of controls. These results suggest that dual axis tracking is subject to separate effects of resource competition, confusions, and Wickens' compatibility of proximity principle. GRA

N88-15441# MacAulay-Brown, Inc., Fairborn, Ohio.
HUMAN PERFORMANCE DATA NEEDED FOR TRAINING DEVICE DESIGN DECISIONS Final Report, 1 Sep. 1985 - 4 Apr. 1986
Gary A. Klein and Christopher P. Brezovic Mar. 1987 59 p Prepared in cooperation with Klein Associates, Inc., Yellow Springs, Ohio
(Contract F33615-82-C-0513)
(AD-A185988; Rept-86-86.1-F; AAMRL-TR-87-010) Avail: NTIS HC A04/MF A01 CSCL 05I

The goal of this project was to study the types of human perception and performance information that training device designers need in making design decisions. There were two objectives: (1) to identify the types of human performance data needed to make these decisions and (2) to make recommendations about decision support for training device designers. A total of 50 experienced designers were studied. For a subset of 42 of these designers, the interviews focused on critical design decisions where there was a need for perception/information processing data. Several types of data were collected from these interviews. One finding indicated that for the sample of critical decisions studied, systematic decision-making strategies were used in a minority of cases. A second result was the identification of frequent questions about human performance data. A third finding revealed the heavy reliance on informal experiments and analogous cases for guidance in resolving design questions, and the lesser reliance on published literature. Implications were presented for the development of Designers' Associate. Future research areas were presented, primarily with methods for helping designers to extrapolate from research data and from analogues cases. GRA

N88-15442# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EVALUATION OF THE SHASTA WATERLESS SYSTEM AS A REMOTE SITE SANITATION FACILITY
C. J. Martel Aug. 1987 28 p
(AD-A186000; CRREL-SR-87-16) Avail: NTIS HC A03/MF A01 CSCL 06I

The waterless toilet manufactured by Shasta Manufacturing, Inc. of Redding, California, was evaluated for possible use at remote military sites and guard stations. A telephone survey of six recreational areas indicated that park personnel were generally pleased with the performance of these units. On-site visits did not encounter offensive odors. Proper ventilation and liquid level control were found to be key factors in successful operation. A rational approach to sizing these units was developed on the basis of local pan evaporation rates. GRA

N88-15443# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
QUANTIFYING SOME INFORMATION PROCESSING ASPECTS OF THE PILOT'S INSTRUMENT CROSSCHECK M.S. Thesis
Joseph L. Bunecke 1987 81 p
(AD-A186114; AFIT/CI/NR-87-127D) Avail: NTIS HC A05/MF A01 CSCL 01D

An aircraft instrument panel contains a multitude of data sources from which a pilot gathers the information needed to safely and efficiently control and navigate the aircraft during flight. In order to insure that instrument indications remain within specified tolerances, pilots switch their attention among/between the various displays by employing a visual scanning technique called crosscheck. While most studies of the pilot's eye movements attempt to model the crosscheck under ideal conditions in an effort to describe an optimal scan, this study approaches the issues from a training perspective to identify a potential cause of and to propose a possible solution to non-optimal scanning. I've divided this analysis into eight chapters. To provide the context for this research, the first describes the task environment in which the pilot uses the crosscheck. In the second and third sections, I review pertinent literature to establish the crosscheck as a skill and use the Multiple Resource theory of attention (Wickens, 1984) as a base to present my rationale for teaching this visual scanning behavior in a part-task scenario. I speculate as to the potential

benefits of teaching and developing crosscheck skills using a graphics-capable computer training-aid in the fourth section. In the final four chapters, I analyze the experimental data gathered by one such training-aid and describe the implications of the results in terms of the present methods of crosscheck instruction. GRA

N88-15444# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
USING MULTIPLE DIALOG MODES IN A USER-SYSTEM INTERFACE TO ACCOMODATE DIFFERENT LEVELS OF USER EXPERIENCE: AN EXPERIMENTAL STUDY Ph.D. Thesis
Roderick A. Taylor 1986 196 p
(AD-A186115; AFIT/CI/NR-87-126D) Avail: NTIS HC A09/MF A01 CSCL 05H

This dissertation investigated a normative theory that says computer users have different dialog needs depending on their level of experience in using a computer. It was developed from the human factors and user-system interface research built upon differences in expert and novice problem solving strategies, memory, and learning. Experts want to control the interaction with a computer as with a command language whereas novices want to be led through their interaction as with menus and prompts. Since most computer interfaces only provide one dialog mode, some portion of a population having a wide range of user experience is not having their user-system interface needs met. This research hypothesizes that the answer to satisfy the needs of a mixed population to have multiple dialog modes that the user is free to choose form and switch between as required. The hypotheses that experts and novices would perform better and be more satisfied with multiple dialog modes than with just one mode were tested empirically in a controlled laboratory setting. Both novice and expert computer users used one of three types of user-system interfaces (menu, command language, or both modes) to perform the same data task. GRA

N88-15445# Emory Univ., Atlanta, Ga. Dept. of Mathematics and Computer Science.
NEW METHODS FOR NUMERICAL SOLUTION OF ONE CLASS OF STRONGLY NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS WITH APPLICATIONS Annual Report
V. I. Oliker and P. Waltman 1986 12 p
(Grant AF-AFOSR-0285-84)
(AD-A186166; AFOSR-87-1191TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The physical phenomena described by nonlinear partial differential equations have become at present the central theme of investigations by many researchers. A good understanding of most physical processes requires accounting for nonlinear effects and, consequently, methods for studying nonlinear equations have to be developed. Among nonlinear equations the Dirichlet problem for the Monge-Ampere equation is the model case for fully nonlinear equations. GRA

N88-15446# Presearch, Inc., Fairfax, Va.
TRANSIENT CLASSIFIER SYSTEMS AND MAN-MACHINE INTERFACE RESEARCH Final Technical Report, 8 Sep. 1986 - 7 Mar. 1987
Robert Sax and Richard Kram 31 Aug. 1987 109 p
(Contract N00014-86-C-0812; RR0-4209)
(AD-A186213; PI-TR-738) Avail: NTIS HC A06/MF A01 CSCL 17A

The results of the experiment showed that transient detection and classification performance are highly independent, and both are very sensitive to signal-to-noise ratio (SNR). Unknown transients were recognized rapidly; however, performance at low SNR was not comparable to that against known transients. Transient specific syntax proved to be an even stronger determinant of performance than the known vs. unknown condition. Novice performance in detecting a target by its transient emissions was comparable to theoretical best current broadband techniques. Experienced sonar operators outperformed the novices by 12 dB. The automatic classification algorithm research demonstrated use of syntactic and semantic state variable feature-space representations to perform computationally efficient classification of transient patterns (50 times real-time in FORTRAN) and large-scale reduction of data (500:1). The algorithm recognized many singular and correlated transient events. An unexpected and exciting result was recognition and modal separation of mixed mode tonal signals as correlated transients in the time domain. GRA

N88-15447# School of Aerospace Medicine, Brooks AFB, Tex.
MAN RATING THE B-1B MOLECULAR SIEVE OXYGEN GENERATION SYSTEM Final Report, Dec. 1984 - Dec. 1985
John B. Tedor and James P. Clink Aug. 1987 54 p
(AD-A186275; USAFSAM-TR-87-4) Avail: NTIS HC A04/MF A01 CSCL 01C

This report sets forth the findings of a test and evaluation (man rating) of the molecular sieve oxygen generation system developed for the 1B Long Range Combat Aircraft. A series of unmanned and manned tests, covering the range of aircraft operating conditions, were conducted on a duplicate of the aircraft breathing system which was assembled in an environmental chamber. The control variables were cabin and aircraft ambient pressure, inlet air temperature and pressure, cabin temperature, and demand flow; and the dependent variables were oxygen concentration, pressure swings in the mask, and time required for backup oxygen to reach the crew after rapid decompression (RD). Oxygen output met or exceeded specification requirements for all but two test points. Under nominal aircraft operating conditions and the maximum average demand flow of 160 liters per minute (1pm), oxygen concentration fell slightly below specification requirements at 25,000 and 28,000 ft cabin altitude. These discrepancies are not considered significant (i.e., will not compromise crew safety), because the probability is very slight that a demand flow rate as high as 160 1pm will ever occur (tests showed that 6 persons taking moderately heavy, rapid breaths generated 135 1pm average demand at ground level). Furthermore, the oxygen partial pressure, in the worst case, was equivalent to breathing air at only 4,000 ft pressure altitude. GRA

N88-15448# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Thermophysiology Group.
IMPROVEMENT OF THE CONSTRUCTION OF PROTECTIVE CLOTHING FOR BETTER WEARABILITY AND COMFORT Final Report
W. A. Lotens Oct. 1986 100 p Prepared in cooperation with Ten Cate Over-All Fabrics, Almelo, Netherlands and Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands
(Contract TEX-23-NL-(N))
(IZF-1986-26; TD-86-4547; ETN-88-91307) Avail: NTIS HC A05/MF A01

The waterproofness and vapor permeability of rainwear samples were determined, and tests were developed. Technologies underlying the vapor permeability of waterproof samples are based on microporosity, continuous films, microfiber weaves and multilayer fabrics. Samples of the first two technologies show excellent vapor permeability, but for continuous films, this depends on the humidity. Semipermeables cause equal thermal strain as impermeables in cold or cool environments but less strain in the heat. For hard work, the moisture accumulation is lower in semipermeables, but still too high. Ventilation due to motion may be increased by good design and is far from negligible, although wind appears to be more powerful. Ventilation and permeability are linked together in a mathematical model that allows the prediction of condensation inside the garment, for an optimal design as to thermal strain and sweat accumulation. ESA

N88-15449# Report Store, Lawrence, Kans.
DEVELOPMENT OF SOVIET STATE ERGONOMIC STANDARDS (GOST) Final Report
Noemi S. Galton and Bernard O. Williams Aug. 1987 21 p
(Contract DAAL02-87-P-3303)
(AD-A185536; HEL-FI-2-87) Avail: NTIS HC A03/MF A01 CSCL 05H

This report outlines the operating procedures of the Soviet State Standards System and identifies the agencies responsible for developing ergonomics standards. Available open information about the relation of State Standards (GOST) and Military applications is provided. The report includes a translation of the short section on Development and Use of Human Factors Engineering Standards from Ergonomics, Principles and Recommendations. The 1983 joint COMECOM human factors handbook. GRA

N88-15450# Report Store, Lawrence, Kans.
SOVIET STATE ERGONOMIC STANDARDS (GOST) Final Report
Bernard O. Williams and Victor Merkin Sep. 1987 34 p
(Contract DAAL02-87-P-3314)
(AD-A185537; HEL-FI-3-87) Avail: NTIS HC A03/MF A01 CSCL 05H

This report identifies ninety-two Soviet standards pertinent to ergonomics. Indexes list the standards by numerical identifier, chronology, industry or commodity, and the type of subject of the standard. GRA

N88-15407# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFECT OF SILVER COMPOUNDS ON MICROFLORA IN WATER RECLAIMED FROM ATMOSPHERIC MOISTURE CONDENSATE IN A CLOSED ENVIRONMENT
M. I. Shikina, Yu. Ye. Sinyak, S. V. Chizhov, and N. B. Kolesina *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 3, May - June 1987 12 Jan. 1988 p 118-121 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 3, May - Jun. 1987 p 80-82 (For primary document see N88-15389 07-52)
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N88-15434# Joint Publications Research Service, Arlington, Va.
NEW BOOK ON SPACE ECOLOGY REVIEWED
V. P. Pishak *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, Volume 21, No. 4, July - August 1987 13 Jan. 1988 p 138-140 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 4, Jul. - Aug. 1987 p 88-89 (For primary document see N88-15412 07-52)
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55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N88-15451# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
RELIABILITY MODELLING FOR FAULT-TOLERANT PARALLEL PROCESSOR M.S. Thesis
Edward I. Gjermundsen Jan. 1987 101 p
(AD-A185867; AFIT/CI/NR-87-51T) Avail: NTIS HC A06/MF A01 CSCL 09B

An architectural configuration for a Fault Tolerant Parallel Processor (FTPP) is defined to meet a space system reliability and throughput requirement. The FTPP utilizes a flexible architecture consisting of a set of interconnected clusters, each of which is a set of interconnected processors. FTPP architectural and redundancy strategies are perturbed to define a more reliable system, and combinatorial reliability models are developed to analyze these perturbations. The perturbations examined include changes to the cluster architecture, the use of redundant clusters, the redistribution of tasks among clusters, and three cluster interconnection schemes: fully linked, centrally linked, and singly linked. The results of these analyses are used to define relationships between FTPP reliability, throughput, and architecture, which should be useful to a system-designer attempting to meet a specific application requirement. GRA

N88-15452# Joint Inst. for Nuclear Research, Dubna (USSR).
MICROPROCESSOR EMULATING THE INTERMEDIATE CODE FOR FORTRAN COMPILER
S. M. Frolikov and M. N. Shumakov 1986 16 p In RUSSIAN; In RUSSIAN
(DE88-700540; JINR-R-10-86-712) Avail: NTIS (US Sales Only) HC A03/MF A01

Hardware and software for a fast FORTRAN microprocessor are described. Its machine language is an intermediate code of RT-2 and RSX-2 FORTRAN compiler. The time of execution of FORTRAN programs with 16-bit integer and 32-bit real numbers is by a factor of 12 better than that of SM-4 computer. Approximately 6-fold increase in speed of response is achieved due to faster hardware and a 2-fold increase as a consequence of more effective system architecture and instruction list. The processor is intended for use in data acquisition systems of high energy physics setups and could be used as a co-processor of SM-4, and Elektronika-60 type computers. DOE

N88-15453# Stanford Linear Accelerator Center, Calif.
AN INTERACTIVE VISUAL INTERFACE FOR FASTBUS DIAGNOSTICS
D. M. Gelphman, D. B. Gustavson, and H. V. Walz Sep. 1987 3 p Presented at the Nuclear Science Symposium, San Francisco, Calif., 21 Oct. 1987
(Contract DE-AC03-76SF-00515)
(DE88-002569; SLAC-PUB-4416; CONF-871006-13) Avail: NTIS HC A02/MF A01

Complex instruments which are not used regularly, such as diagnostic devices, are often avoided or inefficiently used because of the start-up effort required to figure out how to apply them. To solve this problem, we have developed a visual interface for the SLAC FASTBUS Snoop Module. This interface is based on the Macintosh computer's standard human interface, using menus, dialogs and graphics to quickly bring to mind the range of possibilities and allow easy setup and manipulation of the Snoop module's powerful features. DOE

N88-15615*# Alabama Univ., Huntsville. Dept. of MIS/MSC.
MICROPROCESSOR CONTROL AND NETWORKING FOR THE AMPS BREADBOARD
Stephen A. Floyd *In* NASA. Marshall Space Flight Center,

Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program 20 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N88-15454# Office of Naval Research, London (England).
HIGHLIGHTS OF THE 70TH FLIGHT MECHANICS PANEL SYMPOSIUM ON FLIGHT VEHICLE DEVELOPMENT TIME AND COST REDUCTION
Dennis R. Sadowski 1 Sep. 1987 5 p Symposium held in Toulouse, France, May 1987
(AD-A185831; ONRL-7-026-C) Avail: NTIS HC A02/MF A01 CSCL 01C

Selected presentations given at this meeting, held in May 1987 in Toulouse, France, are reviewed. Topics of the papers include cost estimating, use of CAE-CAD-CAM, prototype manufacturing, and computer-integrated manufacturing. GRA

N88-15455# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
MASSIVELY PARALLEL IMPLEMENTATIONS OF THEORIES FOR APPARENT MOTION Memorandum Report, period ending 1987
Norbeto M. Grzywacz and Alan L. Yuille Jun. 1987 39 p
(Contract N00014-85-K-0124)
(AD-A185841; AI-M-888) Avail: NTIS HC A03/MF A01 CSCL 14D

Two ways of solving the correspondence problem for motion are investigated using the assumptions of minimal mapping and rigidity. Massively parallel analog networks are designed to implement these theories. Their effectiveness is demonstrated with mathematical proofs and computer simulations. We discuss relevant psychophysical experiments. Author (GRA)

N88-15456# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PARALLEL ALGORITHMS FOR COMPUTER VISION ON THE CONNECTION MACHINE
James J. Little Nov. 1986 30 p
(Contracts DACA76-85-C-0010; N00014-85-K-0124)
(AD-A185842; AI-M-928) Avail: NTIS HC A03/MF A01 CSCL 09B

The Connection Machine is a fine-grained parallel computer having up to 64K processors. It supports both local communication among the processors, which are situated in a two-dimensional mesh, and high bandwidth communication among processors at arbitrary locations, using a message-passing network. Solutions to a set of Image Understanding problems for the Connection Machine are presented. These problems were proposed by DARPA to evaluate architectures for Image Understanding systems, and are intended to comprise a representative sample of fundamental procedures to be used in Image Understanding. The solutions on the Connection Machine embody general methods for filtering images, determining connectivity among image elements, determining spatial relations of image elements and computing graph properties, such as matchings and shortest paths. GRA

N88-15457# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
FORMALIZING REUSABLE SOFTWARE COMPONENTS IN THE PROGRAMMER'S APPRENTICE
Charles Rich and Richard C. Waters Feb. 1987 28 p
(Contract N00014-85-K-0124; Grant NSF-MCS-79-12179)
(AD-A185843; AI-M-954) Avail: NTIS HC A03/MF A01 CSCL 09B

There has been a long-standing desire in computer science for a way of collecting and using libraries of standard software components. Unfortunately, there has been only limited success in actually doing this. The lack of success stems not from any resistance to the idea, nor from any lack of trying, but rather from the difficulty of choosing an appropriate formalism for representing components. For a formalism to be maximally useful, it must satisfy five key desiderata: expressiveness, convenient combinability, semantic soundness, machine monipulability, and programming language independence. The Plan Calculus formalism developed as part of the Programmer's Apprentice project satisfies each of these desiderata quite well. It does this by combining the ideas from flowchart schemas, data abstracton, logical formalisms, and program transformations. The efficacy of the Plan Calculus has been demonstrated in part by a prototype program editor called the knowledge-based Editor in Emacs. This editor makes it possible for a programmer to construct a program rapidly and reliably by combining componenets represented as planned. GRA

N88-15458# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PROGRAM TRANSLATION VIA ABSTRACTION AND REIMPLEMENTATION
Richard C. Waters Dec. 1986 45 p
(Contract N00014-85-K-0124; Grant NSF-MCS-79-12179)
(AD-A185845; AI-M-949) Avail: NTIS HC A03/MF A01 CSCL 09B

Essentially all program translators (both source-to-source and compilers) operate via transliteration and refinement. The source program is first transliterated into the target language on a statement by statement basis. Various refinements are then applied in order to improve the quality of the output. Although acceptable in many situations, this approach is fundamentally limited in the quality of output it can produce. In particular, it tends to be insufficiently sensitive to global features of the source program and too sensitive to irrelevant local details. This paper presents an alternate translation paradigm -- abstraction and reimplementation. Using this paradigm, the source program is first analyzed in order to obtain a programming language independent, abstract understanding of the computation performed by the program as a whole. The program is then reimplemented in the target language based on this understanding. The key to this approach is the abstract understanding obtained. It allows the translator to see the forest for the trees - benefiting from an appreciation of the global features of the source program without being distracted by irrelevant details GRA

N88-15459# Technical Solutions, Inc., Mesilla Park, N. Mex.
DOCUMENTATION IN A SOFTWARE MAINTENANCE ENVIRONMENT Interim Technical Report, 1 Aug. 1985 - 31 Jul. 1987
L. D. Landis, A. J. Fine, W. L. Hembree, A. L. Gilbert, and P. M. Hyland 28 Aug. 1987 103 p
(Contract DAAG29-85-C-0026)
(AD-A185892; ARO-22935.1-EL-S) Avail: NTIS HC A06/MF A01 CSCL 09B

Software has a limited lifetime, because as existing software ages support becomes more difficult. Major factors in determining when to replace rather than maintain software are the cost of and to the time required to train new personnel to provide maintenance support. A primary source of information in training new personnel, making modification or repair easier, is accurate documentation. By providing automatic techniques to generate documentation of existing software, the life-cycle of software may be extended through accurate information about the current state of the software. The objective of this effort was to explore and select methods of documentation that automatically extract and display program logic from source code, thereby extending the life-cycle of software. The domain of problems the research examined involved looking into the various weaknesses and vulnerabilities of software and documentation that ages. GRA

N88-15460# Tecolote Research, Inc., Santa Barbara, Calif.
A PLAN FOR COLLECTING ADA SOFTWARE DEVELOPMENT COST, SCHEDULE AND ENVIRONMENT DATA
Neal J. Brenner, Daniel D. Galorath, David G. Lawrence, and Judy C. Rampton 2 Apr. 1987 157 p
(Contract F19628-84-D-0019)
(AD-A185905; CR-0134/1; ESD-TR-87-167) Avail: NTIS HC A08/MF A01 CSCL 09B

This report identifies data that can be collected and used to measure the impact Ada has on the cost of developing military-standard software. Several potential cost driver impacts and issues have been identified. This task was completed using the following steps. First, a literature search was performed as described in section 3. Next, an interview questionnaire was created to be used as a basis for interviews with software modelers, Ada software engineering experts, and Ada project managers. Their responses to the interview questions, detailed in sections 4 and 5, expanded the issues and impacts determined from the literature search. Then, the Ada cost driver issues and impacts were used to modify existing data collection packages to be used to draw out the Ada cost impacts. Data elements that need to be collected and methodologies to be used when developing an Ada Software Cost Database were identified. Various data collection formats that can be used for data collection and cross references the data elements with ESD TR-87-166 are presented. GRA

N88-15461# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION AND IMPLEMENTATION OF AN ALGORITHM FOR COMPUTING OPTIMAL SEARCH PATHS M.S. Thesis
James F. Caldwell, Jr. Sep. 1987 88 p
(AD-A185927; AD-F000114) Avail: NTIS HC A05/MF A01 CSCL 09B

A moving target is detected at long range with an initial position given by a probability distribution on a grid of N cells. Also located on the grid is a searcher, constrained by speed, who must find an optimal search path in order to minimize the probability of target survival by time T. A branch-and-bound algorithm designed by Professors Eagle and Yee of the Naval Postgraduate School in Monterey, California, is successfully implemented in order to solve this problem. Within the algorithm, the problem is set up as a nonlinear optimization of a convex objective function subject to the flow constraints of an acyclic N x T network. Lower bounds are obtained via the Frank-Wolfe method of solution specialized for acyclic networks. This technique relies on linearization of the objective function to yield a shortest path problem that is solvable by dynamic programming. For each iteration, the lower bound can be found by use of a Taylor first order approximation. Implementation of this algorithm is accomplished by the use of a Fortran program which is run for several test cases. The characteristics of the solution procedure as well as program results are discussed in detail. Finally, some real world applications along with several questions requiring further research are proposed. GRA

N88-15462# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A SOFTWARE PLANNING AND DEVELOPMENT METHODOLOGY WITH RESOURCE ALLOCATION CAPABILITY Ph.D Thesis
Joseph B. Michels 1986 153 p
(AD-A186088; AFIT/CI/NR-87-129D) Avail: NTIS HC A08/MF A01 CSCL 05A

The purpose of this research are to examine the planning and development of large, generic based software development projects and to propose a structured methodology for software planning and development (SPD). The SPD methodology presented parallels the classic software life cycle model to structure decision making and resource planning in a variety of environments. The concepts of kernal construct and templates are developed in conjunction with a resource planning and allocation procedure. Three distinct elements are integrated throughout the proposed methodology: Technical, Managerial, and Resource Use determination. Manpower loading relationships are developed to devise an allocation scheme for different personnel resources required within the software development effort. The generic kernel and associated templates are shown to apply to virtually any type of software development environment. A major software development project is comprised of many different function or routine within the software design. Various templates are used to tailor the kernals to a specific application environment. This tailoring facilitates graphical depiction of the necessary interconnections, databases, and protocols to be identified. GRA

N88-15463# Science Applications International Corp., McLean, Va.
PROCEEDINGS OF IMAGE UNDERSTANDING WORKSHOP, VOLUME 1 Annual Report, Dec. 1985 - Feb. 1987
Lee S. Baumann Feb. 1987 426 p Workshop held in Los Angeles, Calif., 23-25 Feb. 1987
(Contract N00014-86-C-0700; ARPA Order 5605)
(AD-A186103) Avail: NTIS HC A19/MF A01 CSCL 09B

This document contains the outlines of annual progress reports and technical papers presented by the research activities in Image Understanding, sponsored by the Information Science and Technology Office; Defense Advanced Research Projects Agency. The papers were presented at a workshop conducted on 23 to 25 February 1987, in Los Angeles, California. Also included are copies of invited papers presented at the workshop and additional technical papers from the research activities which were not presented due to lack of time but are germane to this research field. GRA

N88-15464# Science Applications International Corp., McLean, Va.
PROCEEDINGS OF IMAGE UNDERSTANDING WORKSHOP, VOLUME 2 Annual Report, Dec. 1985 - Feb. 1987
Lee S. Baumann Feb. 1987 613 p Workshop held in Los Angeles, Calif., 23-25 Feb. 1987
(Contract N00014-86-C-0700; ARPA Order 5605)
(AD-A186104) Avail: NTIS HC A99/MF A01 CSCL 09B

The partial contents of the Proceedings of the Image Understanding Workshop are as follows: Guiding an Autonomous Land Vehicle Using Knowledge-Based Landmark Recognition; The Image Understanding Architecture; Initial Hypothesis Formation in Image Understanding Using an Automatically Generated Knowledge Base; What is a Degenerate View; Recognizing Unexpected Objects: A Proposed Approach; Minimization of the Quantization Error in Camera Calibration; Tracing Finite Motions Without Correspondence; The Formation of Partial 3D Models from 2D Projections - An Application of Algebraic Reasoning; Qualitative Information in the Optical Flow; Detecting Blobs as Textons in Natural Images; and Parallel Optical Flow Computation. GRA

N88-15465# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
COMPUTER AIDED DESIGN FOR PETRI NETS
John Kyratzoglou Aug. 1987 189 p
(Contract N00014-85-K-0782)
(AD-A186109; LIDS-TH-1694) Avail: NTIS HC A09/MF A01 CSCL 05A

The developement of an interactive Petri Net Editor, used for computer aided construction and analysis of arbitrary organizational architectures is presented. The Petri Net Editor consists of four major modules. The Graphics Module, which utilizes a set of graphical abstractions, is used to generate or modify structures, create or delete supernodes, form a large structure from smaller ones and select a flow path from a set of possible flow paths. The graphical representation generates a data structure which serves as the input to a number of algorithms for computing structural properties of an organizational architecture. The Text Module generates a data base to store and retrieve attributes represented by graphical abstractions. The Hardcopy Module produces output on a printer and a plotter. A User's Document is appended. GRA

N88-15466# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations engineering.
A MULTICUT ALGORITHM FOR TWO-STAGE STOCHASTIC LINEAR PROGRAMS
John R. Birge and Francois V. Louveaux Dec. 1986 22 p
(Contract N00014-86-K-0628; Grant NSF-ECS-83-04065)
(AD-A186148; TR-85-15) Avail: NTIS HC A03/MF A01
CSCL 09B

Outer linearization methods, such as Van Slyke and Wets's L-shaped method for stochastic linear programs, generally apply a single cut on the nonlinear objective at each major iteration. The structure of stochastic programs allows for several cuts to be placed at once. This paper describes a multicut algorithm to carry out this procedure. It presents experimental and theoretical justification for reductions in major iterations. GRA

N88-15467# Florida Univ., Gainesville.
IMAGE PROCESSING LANGUAGE DEVELOPMENT Final Report, Dec. 1986 - Jan. 1987
Gerhard X. Ritter 2 Jul. 1987 3 p
(Grant AF-AFOSR-0258-86)
(AD-A186251; AFOSR-87-0966TR) Avail: NTIS HC A02/MF
A01 CSCL 09B

This University Research Instrumentation Program (URIP) grant was used to purchased Sun 3 workstations to enhance the development of image processing facilities at the University of Florida. Several image processing research projects have made use of this equipment including the following topic: (1) image processing language development, (2) target distance measurement, (3) image complexity measures and their use in selection of optimum edge detection algorithms, and (4) global dataflow analysis optimization for image processing programs. GRA

N88-15468# Naval Postgraduate School, Monterey, Calif.
TRACKING PROCEDURE FOR NON-NORMALLY DISTRIBUTED MEASUREMENT ERRORS M.S. Thesis
Alexander Kukliansky Sep. 1987 59 p
(AD-A186287) Avail: NTIS HC A04/MF A01 CSCL 09B

The Kalman Filter is a widely used procedure in tracking algorithms. When normality assumptions are violated, the Kalman Filter performance tends to degrade. In this thesis a new procedure is introduced for accommodating non-normal properties of measurement error distributions. The procedure is developed for the multi-observer situation. Simulation experiment results are presented and numerical comparisons are made between the Kalman Filter performance and that of the new procedure. Author (GRA)

N88-15469# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
RECURSIVE M-ESTIMATORS OF LOCATION AND SCALE FOR DEPENDENT SEQUENCES
Jan-Eric Englund, Ulla Holst, and David Ruppert Nov. 1986 21 p
(Contract F49620-85-C-0144)
(AD-A186292; AFOSR-87-1251TR) Avail: NTIS HC A03/MF
A01 CSCL 09B

Recursive M-estimators of location and scale may be obtained via stochastic approximation algorithms. The case is considered when the observations can be described by a strictly stationary process satisfying certain strong mixing conditions and results on strong convergence are given. The asymptotic distributions of the estimators for sequences of independent observations are also discussed. GRA

N88-15470# Maryland Univ., College Park. Dept. of Computer Science.
PARALLEL LOGIC PROGRAMMING AND ZMOB AND PARALLEL SYSTEMS SOFTWARE AND HARDWARE Final Report
Jack Minker and Mark Weiser Dec. 1986 17 p
(Grant AF-AFOSR-0303-82)
(AD-A186300; AFOSR-87-1271TR) Avail: NTIS HC A03/MF
A01 CSCL 12A

Under the current grant parallel hardware and systems software implemented on ZMOB in the previous year underwent extensive testing. A parallel problem solving system, PRISM (Parallel Inference System) implemented on the VAX/11-780 in the previous year was implemented on the PYRAMID and SUN machines. The initial version of PRISM uses a simulation of the ZMOB hardware, and has been fully tested and debugged. Experimental testing of PRISM on the simulated system was undertaken in the current year. In addition, several enhancements were made to PRISM to permit experimental analyses to be made, and to incorporate additional features to take full advantage of parallelism in a problem solving environment. The tracing and statistical gathering packages were extended. An AND-parallelism capability was added to achieve a second version of the PRISM system, and other features were added to the system to more fully exploit parallelism. A constraint solving machine was integrated with PRISM. In addition to the above, a general method to permit informative answers to be presented to a user has been developed. Theoretical results were obtained for circumscription and a method for computing in protected circumscription, using Horn clauses was developed. In the area of systems hardware and software, the ZMOB processor is now fully functional and in everyday use with 128 processors. GRA

N88-15471# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
VERSION DESCRIPTION DOCUMENT FOR THE ADA COMPILER VALIDATION CAPABILITY (VERSION 1.9) (FOR MICROCOMPUTER)
20 Jul. 1987 48 p
(AD-A186390; DOT/SW/DK-88/003A) Avail: NTIS HC
A03/MF A01 CSCL 09B

The Ada Compiler Validation Capability (ACVC) is a suite of tests designed to determine an Ada complier's conformance to MIL-STD-1815A, the Ada Language Reference Manual (LRM). Version 1.9 was released in December 1986 and became the official ACVC version, replacing 1.8, in June 1987. ACVC version 1.9 will be the official version until June 1988 when it will be replaced by ACVC version 1.10. Each of the 3122 tests in the ACVC 1.9 is designed to test a single test objective specified in the Ada Implementor's Guide (AIG), a document enumerating the LRM into discrete test objectives in order to aid compiler development. GRA

N88-15472# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
AUTOMATED PROGRAM RECOGNITION M.S. Thesis
Linda M. Wills Feb. 1987 203 p
(Contract N00014-85-K-0214; Grant NSF-DCR-81-17633)
(AD-A186421; AI-TR-904) Avail: NTIS HC A10/MF A01
CSCL 12A

The key to understanding a program is recognizing familiar algorithms fragments and data structures in it. Automating this recognition process will make it easier to perform many tasks which require program understanding, e.g., maintenance, modification, and debugging. This report describes a recognition system, called the Recognizer, which automatically identifies occurrences of stereotyped computational fragments and data structures in programs. The Recognizer is able to identify these familiar fragments and structures, even though they may be expressed in a wide range of syntactic forms. It does so systematically and efficiently by using a parsing technique. Two important advances have made this possible. The first is a language-independent graphical representation for programs and programming structures which canonicalizes many syntactic features of programs. The second is an efficient graph parsing algorithm. GRA

N88-15473# Army Tank-Automotive Systems Development Center, Warren, Mich.
CREATING TITLE BLOCKS FOR VEHICLE ANIMATIONS Final Report, Jun. - Aug. 1987
Christopher E. Morlan 12 Aug. 1987 9 p
(AD-A185620; TACOM-TR-13280) Avail: NTIS HC A02/MF A01 CSCL 09B

This report is intended to describe an efficient method of creating title blocks for vehicle animations. It details the use of the FORTRAN program FONT and the various manners in which the resulting title blocks may be displayed and used. FONT uses the Lexidata device and the VAX 8800 computer system. GRA

N88-15474# Los Alamos National Lab., N. Mex.
AFTER TEN YEARS OF METAFILES: WHERE DOES THE COMPUTER GRAPHICS METAFILE FIT
T. N. Reed 1987 8 p Presented at the Workshop on the CGM in the Real World, Gaithersburg, Md., 15 Sep. 1987
(Contract W-7405-eng-36)
(DE88-001840; LA-UR-87-3385; CONF-8709181-1) Avail: NTIS HC A02/MF A01

The need at Los Alamos National Laboratory for the Computer Graphics Metafile standard and supporting software is discussed. A brief history of metafile usage at Los Alamos is given. This is followed by an overview of our computing environment and a description of our computer graphics system. Issues faced in making the transition from the metafile to a system supporting the Computer Graphics Metafile and related graphics standards is then discussed. The present graphics software was designed to address specific needs at Los Alamos. The transition to the Computer Graphics Metafile and other related standards can take place only when these needs are met in the marketplace. DOE

N88-15475# Allied Bendix Corp., Kansas City, Mo.
INTELLIGENT CONTROLLERS
V. E. Gross Oct. 1987 12 p Presented at the CAM-I ANC Interest Group Meeting, Cincinnati, Ohio, 29 Sep. 1987
(Contract DE-AC04-76DP-00613)
(DE88-001862; BDX-613-3842; CONF-8709167-1) Avail: NTIS HC A03/MF A01

The Intelligent Controller as a critical element in implementing factory automation and its general requirements are discussed. A brief review of the history of N/C controls, minicomputers, the APT programming language, and the potential role the ANC (Advanced Numerical Control) processor may play in Intelligent Controllers are also discussed. DOE

N88-15476# Stringer (James C.), Austin, Tex.
SOFTWARE ENHANCEMENTS AND MODIFICATIONS TO PROGRAM FDTD EXECUTABLE ON THE CRAY X-MP COMPUTER
James C. Stringer Sep. 1987 17 p
(Contract W-7405-eng-48)
(DE88-001877; UCRL-15957) Avail: NTIS HC A03/MF A01

This report summarizes enhancements and modifications to PROGRAM FDTD executable on the Cray X-MP computer system. Specifically, the tasks defined and performed under this effort are a revision of the material encoding/decoding scheme to allow material type specification on an individual cell basis; modification of the I/O buffering scheme to maximize the use of available central memory and minimize the number of physical I/O accesses; user interface enhancements; provision of enhanced input/output features for greater flexibility; and increased modularity. The codes are divided into additional modules for ease of maintenance and future enhancements, and for assistance in the conversion and testing of FDTD to Floating Point Systems scientific computers and associated peripheral devices. DOE

N88-15477# Sandia National Labs., Albuquerque, N. Mex.
DOE DATA EXCHANGE FORMAT SPECIFICATION, MECHANICAL PRODUCTS/DRAFTING: VERSION 1.2.2: CADCAM-045
Sep. 1987 38 p
(Contract DE-AC04-76DP-00789)
(DE88-001923; SAND-87-2037) Avail: NTIS HC A03/MF A01

The Data Exchange Format (DEF) has been developed as part of a Department of Energy (DOE) effort to integrate the Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) activities throughout the Nuclear Weapons Complex (NWC). A primary objective of this effort is to provide a capability for the exchange of digital data between dissimilar CAD/CAM systems within the NWC. This specification is the result of a collective effort of the DOE Data Exchange Format Group charged with the task of defining a subset of the Initial Graphics Exchange Specification (IGES) to be used as the data exchange format for the mechanical products/drafting application. DOE

N88-15478# Texas Univ., Austin. Center for Numerical Analysis.
PARALLEL LU-FACTORIZATION ALGORITHMS FOR DENSE MATRICES
T. C. Oppe and D. R. Kincaid May 1987 25 p Presented at the ICS International Conference on Supercomputing, Athens, Greece, 8 Jun. 1987
(Contract DE-AS05-81ER-10954)
(DE88-002179; CONF-8706183-2; CNA-213) Avail: NTIS HC A03/MF A01

Several serial and parallel algorithms for computing the LU-factorization of a dense matrix are investigated. Numerical experiments and programming considerations to reduce bank conflicts on the Cray X-MP4 parallel computer are presented. Speedup factors are given for the parallel algorithms. DOE

N88-15479# Stanford Univ., Calif. Systems Optimization Lab.
A SCHUR-COMPLEMENT METHOD FOR SPARSE QUADRATIC PROGRAMMING
P. E. Gill, W. Murray, M. A. Saunders, and M. H. Wright Oct. 1987 24 p
(Contract DE-FG03-87ER-25030)
(DE88-002520; SOL-87-12) Avail: NTIS HC A03/MF A01

In applying active-set methods to sparse quadratic programs, it is desirable to utilize existing sparse-matrix techniques. We describe a quadratic programming method based on the classical Schur complement. Its key feature is that much of the linear algebraic work associated with an entire sequence of iterations involves a fixed sparse factorization. Updates are performed at every iteration to the factorization of a smaller matrix, which may be treated as dense or sparse. The use of a fixed sparse factorization allows an off-the-shelf sparse equation solver to be used repeatedly. This feature is ideally suited to problems with structure that can be exploited by a specialized factorization. Moreover, improvements in efficiency derived from exploiting new parallel and vector computer architectures are immediately applicable. An obvious application of the method is in sequential quadratic programming methods for nonlinearly constrained optimization, which require solution of a sequence of closely related quadratic programming subproblems. We discuss some ways in which the known relationship between successive problems can be exploited. DOE

N88-15480# Norges Tekniske Hoegskole, Trondheim.
MODELLING OF CLUSTERING EFFECTS IN POINT PROCESSES: AN APPLICATION TO FAILURES IN SPC-SYSTEMS (STORED PROGRAM CONTROL-SYSTEMS)
B. E. Helvik and A. R. Swensen Sep. 1986 32 p Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway).
(PB87-149241; ISBN-82-595-4432-6; STF44-A86132) Avail: Issuing Activity CSCL 09B

The paper introduced a failure intensity model with a self-excitation term describing the clustering effect in computer failure data. The model is an extension of a previous non-homogeneous Poisson model used to investigate the influence of load and operational activities on the failure intensity. It allows a straightforward determination of maximum likelihood parameter estimates. Their covariances are estimated using the usual

approximation based on the inverse of the Hessian of the log likelihood, as well as a simulation procedure. The model is applied to data from the failure log of two SPC (stored program control) telephone exchanges, showing that: the model describes the failure pattern reasonably well; a sufficient approximation of the covariances may be obtained from the Hessian; and the increase in the failure intensity during working hours and/or after a failure is highly significant. GRA

N88-15481# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MULTICHANNEL SCALING ANALYZER
N. I. Zhuravlev, A. V. Salamatin, and A. N. Sinaev 1986 9 p In RUSSIAN
(DE88-700541; JINR-R-10-86-716) Avail: NTIS (US Sales Only) HC A02/MF A01

An autonomous multichannel scaling analyzer is described. It consists of: scalers, multiplexer, memory controller for FIFO operation mode, 4Kx16 bit RAM, preset scalers, graphic display driver, controller for the link to a computer. The analyzer carries out the following functions: the writing of data from the scalers to the FIFO memory cells with data adding to cell previous contents, output of the accumulated data to the graphic display, or plotter. DOE

N88-15482# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
ALGORITHM AND PROGRAM FOR RECOGNITION OF COMPACTLY POSITIONED VERTICES OF EVENTS FOR THE HPD MINIMUM GUIDANCE SYSTEM
G. V. Shestakova and V. N. Shigaev 1986 8 p In RUSSIAN; ENGLISH summary
(DE88-700542; JINR-R-10-86-723) Avail: NTIS (US Sales Only) HC A02/MF A01

The ZONVER program algorithm for recognition of event vertices on track chamber photographs is described. The ZONVER program constructs a full set of vertex-type structures in film plane using filtered tracks as source data. The algorithm is suitable for using in automatic scanning and measuring systems for track chamber photograph analysis. DOE

N88-15483# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
PROBLEMS OF ORGANIZATION OF MASS PROCESSES OF SIMULATION, ACQUISITION AND PROCESSING OF EXPERIMENTAL DATA AT COMPUTERS
N. N. Govorun, I. I. Evsikov, and I. M. Ivanchenko 1986 7 p In RUSSIAN; ENGLISH summary Submitted for publication
(DE88-700547; JINR-R-10-86-786) Avail: NTIS (US Sales Only) HC A02/MF A01

The approach, methods and programs of effective organization of mass processes for stimulations, acquisition and processing of experimental data at multiuser computers were considered. In the frames of this approach the efficient increase of reliability and productivity of mass processes for a wide range of alternations of operating surrounding characteristics is provided. The considered principles are illustrated on an example of data processing from the BIS-2 large-scale spectrometer, JINR. DOE

N88-15484# Fermi National Accelerator Lab., Batavia, Ill.
A MULTIPLE NODE SOFTWARE DEVELOPMENT ENVIRONMENT
P. Heinicke, T. Nicinski, P. Constanta-Fanourakis, D. Petravick, R. Pordes, D. Ritchie, and V. White Jun. 1987 7 p Presented at the 5th Conference on Real-Time Computer Applications in Nuclear, Particle and Plasma Physics, San Francisco, Calif., 12 May 1987
(Contract DE-AC02-76CH-03000)
(DE87-010995; FNAL-TM-1463; CONF-870552-15) Avail: NTIS HC A02

Experimenters on over 30 DECnet nodes at Fermilab use software developed, distributed, and maintained by the Data Acquisition Software Group. A general methodology and set of tools have been developed to distribute, use and manage the software on different sites. The methodology and tools are of interest to any group developing and using software on multiple nodes. DOE

N88-15485# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
GENLPLOT: AN INTERACTIVE PROGRAM FOR DISPLAY AND ANALYSIS OF DATA, USER'S MANUAL
J. D. Sullivan and C. C. Grisar Aug. 1987 65 p
(Contract DE-AC02-78ET-51013)
(DE88-002292; DOE/ET-51013/193; PFC/RR-86-19) Avail: NTIS HC A04/MF A01

GENLPLOT is an interactive program written in FORTRAN and running under VAX/VMS that enables technicians, scientists, engineers, and other users to quickly and accurately examine and analyze data. The current version utilizes the GRAPAC4 plot package, reads a standard input file or permits direct data entry, and is optimized for use with data stored in MDS databases. This program has been the principal interactive data analysis tool used on the Tara Tandem Mirror Experiment and on the Constance II Mirror Experiment. The program is menu driven with options selected on command lines distinguished by various prompts. Subsequent changes and additions to the program will be indicated by a version number greater than that appearing in the welcome message and will be documented in the appropriate menu(s). DOE

N88-15486# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
MONTE CARLO PHOTON TRANSPORT ON VECTOR AND PARALLEL SUPERCOMPUTERS Final Report
W. R. Martin and P. F. Nowak Dec. 1986 8 p
(Contract W-7405-eng-48)
(DE88-002503; UCRL-15958) Avail: NTIS HC A02/MF A01

The University of Michigan has been investigating the implementation of vectorized and parallelized Monte Carlo algorithms for the analysis of photon transport in an inertially-confined fusion (ICF) plasma. The goal of this work is to develop and test Monte Carlo algorithms for vector/parallel supercomputers such as the Cray X-MP and Cray-2. Previous effort has resulted in the development of a vectorized photon transport code, named VPHOT, and a companion scalar code, named SPHOT, that performs the same analysis and is used for comparative purposes to assess the performance of the vectorized algorithm. A test problem, denoted the ICF test problem, has been created and tested with the VPHOT and SPHOT codes. By comparison with a reference LLNL calculation of the ICF test problem, the VPHOT/SPHOT codes have been verified to predict the correct results. This report summarizes the progress made during the last year to continue the investigation of vectorized Monte Carlo (parameter studies, alternative vectorized algorithm, alternative target machines) and to extend the work into the area of parallel processing. DOE

N88-15487# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Integrierte Endsysteme.
FORTRAN 77 PROGRAMMING GUIDELINES
Hildegard Schuster 1987 43 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-87-10; ISSN-0176-7739; ETN-88-91006) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 17

Programming rules for FORTRAN 77 are introduced in order to reduce long-term costs of software development and maintenance. General rules are given for the preparation of programs and subroutines, for arithmetic expressions, character quantities, DO-instruction, instruction number, forbidden FORTRAN 77 instructions, input/output functions, code boxes, software and hordware-dependent functions, and program documentation. ESA

N88-15606*# Alabama Univ., Huntsville. Dept. of Computer Science.
INVESTIGATION OF CANDIDATE DATA STRUCTURES AND SEARCH ALGORITHMS TO SUPPORT A KNOWLEDGE BASED FAULT DIAGNOSIS SYSTEM
Edward L. Bosworth, Jr. *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program 15 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

N88-15610*# Tennessee Univ., Chattanooga. Center of Applications - Computer Applications.
ENHANCEMENT OF COMPUTER SYSTEM FOR APPLICATIONS SOFTWARE BRANCH
Alex Bykat *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 43 p (For primary document see Summer Faculty Fellowship Program 43 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

N88-15618*# Oakwood Coll., Huntsville, Ala. Dept. of Business and Information Systems Management.
THE FEASIBILITY OF USING TAE AS THE UIL FOR THE SPACE STATION AND FOR OTHER INTERNAL NASA TASKS AND PROJECTS
Esther Naomi Gill *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program 22 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

N88-15622*# New Mexico State Univ., University Park. Dept. of Mathematical Sciences.
CAN SPACE STATION SOFTWARE BE SPECIFIED THROUGH Ada?
Arthur Knoebel *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program 22 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N88-15488# Naval Postgraduate School, Monterey, Calif.
FACILITY DESIGN VALIDATION OF THE INFORMATION SYSTEMS LABORATORY M.S. Thesis
Timothy A. Holland Sep. 1987 39 p
(AD-A186309) Avail: NTIS HC A03/MF A01 CSCL 09B

When installing a computer system there are many issues which the Information Systems manager must face. This thesis will identify and discuss some of those issues as they pertain to the installation of the Information Sciences Laboratory in Ingersoll Hall, Naval Postgraduate School. The laboratory will contain three local area networks and a number of specialized workstations. The recommendations made in this thesis are the floor plans showing a possible configuration for the laboratory. GRA

N88-15489# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
AFL-1: A PROGRAMMING LANGUAGE FOR MASSIVELY CONCURRENT COMPUTERS M.S. Thesis
Guy Blelloch Nov. 1986 134 p
(Contract N00014-85-K-0124)
(AD-A186422; AI-TR-918) Avail: NTIS HC A07/MF A01 CSCL 09B

Computational models are arising in which programs are constructed by specifying large networks of very simple computational devices. Although such models can potentially make use of a massive amount of concurrency, their usefulness as a programming model for the design of complex systems will ultimately be decided by the design of complex systems will ultimately be decided by the ease in which such networks can be programmed (constructed). This thesis outlines a language for specifying computational networks. The language (AFL-1) consists of a set of primitives, and a mechanism to group these elements into higher level structures. An implementation of this language runs on the Thinking Machines Corporation, Connection Machine. Two significant examples were programmed in the language, an expert system (CIS), and a planning system (AFPLAN). These systems are explained and analyzed in terms of how they compare with similar systems written in conventional languages. GRA

N88-15490# Texas Univ., Austin. Dept. of Computer Sciences.
UNITY: A FRAMEWORK FOR STUDY OF PARALLEL PROGRAMMING PROBLEM-SOLVING Final Report, 15 Jun. 1985 - 14 Oct. 1986
K. M. Chandy and J. Misra 24 Mar. 1987 14 p
(Grant AF-AFOSR-0252-85)
(AD-A185616; AFOSR-87-1577TR) Avail: NTIS HC A02/MF A01 CSCL 09B

Our work has concentrated on developing a unifying framework, under the name UNITY, for studying problem-solving in parallel programming independent of specific architectural considerations. We have proposed a simple model of computation and a logic to reason about properties of such programs and have managed to study problems from a variety of problem areas. We have developed a number of transformations which are appropriate for implementations on a variety of architectures: sequential, asynchronous shared memory, distributed message passing, synchronous parallel with shared memory, systolic arrays, and VLSI chips. The diversity of the application areas and the architectures studied lends credence to our hypothesis that there is a UNITY to programming. GRA

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N88-15491# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A DIRECTED METHOD FOR LOCATING THE FOCUS OF EXPANSION
Shariar Negahdaripour and Berthold K. Horn Jan. 1987 30 p
(Contract N00014-75-C-0643; Grant NSF-DMC-85-11966)
(AD-A185840; AI-M-939) Avail: NTIS HC A03/MF A01 CSCL 14D

The problem of recovering the motion of a monocular observer relative to a rigid scene is discussed. No assumptions are made about the shapes of the surfaces in the scene, nor are estimates made of the optical flow or point correspondences. Instead, the spatial gradient and the time rate of change of brightness is exploited over the whole image and the constraint is explicitly imposed that the surface of an object in the scene must be in front of the camera for it to be imaged. GRA

N88-15492# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
IMAGE UNDERSTANDING BY IMAGE-SEEKING ADAPTIVE NETWORKS (ISAN) Final Technical Report, 1 May 1983 - 30 Apr. 1986
D. N. Spinelli 10 Aug. 1987 116 p
(Grant AF-AFOSR-0207-83)
(AD-A186214; AFOSR-87-1286TR) Avail: NTIS HC A06/MF A01 CSCL 09B

A remarkably simple, experimentally inspired, new theory of vision is presented. The theory takes into account the parallel

architecture, the adaptive phenomena and the efferent control system which have been demonstrated in the vision systems of organisms. Further the complexities of visual receptive fields are made use of to explain the speed, noise resistance, consistencies and holistic aspects of perception. In this theory image understanding is achieved by image seeking adaptive networks that differentially amplify images of interest without first breaking them down into elementary components. A computer implementation of the theory demonstrates that the mechanisms postulated are feasible. A number of experiments with the model address critical aspects of image understanding and demonstrate that images of interest are captured reliably even in large amounts of noise, or in spite of position and/or size changes. Subjective edges, and other Gestalt like images, i.e. horizon and terrain are also seen by ISAN's basic network. Some implications for general vision are outlined. GRA

N88-15493# Dutch Foundation for Measurement and Control Technology, Delft.
[SCIENTIFIC RESEARCH IN THE FIELD OF MEASUREMENT AND CONTROL TECHNOLOGY] Annual Report, 1985 [WETENSCHAPPELIJK ONDERZOEK IN DE MEET- EN BESTURINGSTECHNOLOGIE IN NEDERLAND. JAARBOEK 1985]
Feb. 1986 330 p Partly in DUTCH and ENGLISH
(SMBT-322; ETN-88-90617) Avail: NTIS HC A15/MF A01

Research projects in the following fields are summarized: apparatus for process industry, refrigeration techniques and air conditioning; mechanical measuring and control techniques and cybernetic ergonomic stability and steering, control engineering; electronics instrumentation; information theory; signal and systems engineering; transport phenomena; bioprocess technology; applied analysis; production technology and mechanization; fundamental mechanical engineering; measuring and controlling; decision theory and stochastics; systems and control engineering; analysis of physical measuring methods; organization psychology; process control and environmental control; steering systems and computer engineering; systems and steering theory; measuring and systems engineering; systems and control engineering; physics and meteorology; water-course studies; calibrating techniques; aerospace systems; behavior in traffic; and preventive medicine. ESA

N88-15494# Oxford Univ. (England). Dept. of Engineering Science.
SIMPLIFIED SELF-TUNING CONTROL ALGORITHMS
K. Warwick 1986 63 p
(OUEL-1657/86; ETN-88-90964) Avail: NTIS HC A04/MF A01

Self-tuning controllers based on the philosophy that during every sample period the following sequence of events must be followed: (1) sample the system output signal, (2) estimate the system characteristics, (3) form the new controller, and (4) calculate and apply the new control input, then wait for a clock pulse before returning to (1) are described. Simplifications and approximations to, and simplified versions of, the basic self-tuning control building blocks are considered, to reduce drastically the amount of computation required in the implementation of a self-tuning control algorithm, and to reveal adaptive controllers which are merely improved approaches to the widely employed PID digital control algorithms. Approximations to parameter estimation schemes are considered. It is shown how the use of a computationally more efficient estimation algorithm does not necessarily mean loss of convergence or accuracy properties. Model reduction techniques to provide a possible route in the adaptive control of high order systems are presented. Simplified controller schemes, (PID and deadbeat) are discussed. ESA

N88-15495# Oxford Univ. (England). Dept. of Engineering Science.
OPTIMAL OBSERVERS FOR ARMA MODELS
1986 27 p Sponsored by GEC Hirst Research Center, Wembley, United Kingdom
(OUEL-1659/86; ETN-88-90965) Avail: NTIS HC A03/MF A01

Two state-space formulations of the ARMA model are considered. By deriving optimal observer conditions it is shown that the state estimator effectively employed in many polynomial based controller/regulator designs is optimal in the sense not of the commonly encountered innovations model but rather in the sense of a noise free measurement state-space model. It is felt that this result questions the widespread automatic use of an innovations model as a state-space formulation for ARMA models. ESA

N88-15496# Los Alamos National Lab., N. Mex.
IMPROVED INPUT REPRESENTATION FOR ENHANCEMENT OF NEURAL NETWORK PERFORMANCE
C. H. Aldrich, Z. G. An, K. Lee, and Y. C. Lee 1987 10 p Presented at the Workshop on Complex Adaptive System, Santa Fe, N. Mex., 1 Oct. 1987
(Contract W-7405-eng-36)
(DE88-001830; LA-UR-87-3441; CONF-8710189-1) Avail: NTIS HC A02/MF A01

The performance of an associate memory network depends significantly on the representation of the data. For example, it has already been recognized that bipolar representation of neurons with -1 and +1 states outperform neurons with on and off states of +1 and 0 respectively. This paper will show that a simple modification of the pattern vector to have zero bias will provide even more significant increase for the performance of an associative memory network. The higher order algorithm is used for the numerical simulation studies of this paper. To the lowest order this algorithm reduces to the Hopfield model for auto-associative memory and the bidirectional associative memory (BAM) for hetero-associative memory model respectively. DOE

N88-15497*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INTEGRATION OF SYMBOLIC AND ALGORITHMIC HARDWARE AND SOFTWARE FOR THE AUTOMATION OF SPACE STATION SUBSYSTEMS
Hugh Gregg, Kathleen Healey, Edmund Hack, and Carla Wong (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) Oct. 1987 9 p Presented at the 3rd Conference on Artificial Intelligence for Space Applications, Huntsville, Ala., 2 Nov. 1987
(Contract W-7405-eng-48)
(NASA-TM-89705; NAS 1.26:89705; DE88-002386; UCRL-97570; CONF-871182-1) Avail: NTIS HC A02/MF A01 CSCL 09B

Traditional expert systems, such as diagnostic and training systems, interact with users only through a keyboard and screen, and are usually symbolic in nature. Expert systems that require access to data bases, complex simulations and real-time instrumentation have both symbolic as well as algorithmic computing needs. These needs could both be met using a general purpose workstation running both symbolic and algorithmic code, or separate, specialized computers networked together. The latter approach was chosen to implement TEXSYS, the thermal expert system, developed by NASA Ames Research Center in conjunction with Johnson Space Center to demonstrate the ability of an expert system to autonomously monitor the thermal control system of the space station. TEXSYS has been implemented on a Symbolics workstation, and will be linked to a microVAX computer that will control a thermal test bed. This paper will explore the integration options, and present several possible solutions. DOE

N88-15498# Oak Ridge National Lab., Tenn.
PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON METHODOLOGIES FOR INTELLIGENT SYSTEMS: COLLOQUIA PROGRAM
Z. W. Ras, ed., M. L. Emrich, ed., and A. W. Jankowski, ed. Sep. 1987 354 p Symposium held at Charlotte, N.C., 14 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001490; ORNL-6417; CONF-871043) Avail: NTIS HC A16/MF A01

The following topics were presented at the Intelligent Systems Symposium: Approximate Reasoning; Expert Systems; Intelligent Databases; Knowledge Representation; Learning and Adaptive Systems; Logic for Artificial Intelligence; and Man-Machine Interaction. Thirty-three papers have been cataloged separately.
DOE

N88-15628*# Alabama Univ., Huntsville. Dept. of Computer Science.
EXPERT SYSTEM TECHNOLOGY
Mary Ellen Prince *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 17 p (For primary document see Summer Faculty Fellowship Program 17 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N88-15499# California Univ., Santa Barbara. Algebra Inst.
STABILITY ANALYSIS OF FINITE DIFFERENCE SCHEMES FOR HYPERBOLIC SYSTEMS, AND PROBLEMS IN APPLIED AND COMPUTATIONAL LINEAR ALGEBRA Interim Report, 1 May 1986 - 30 Apr. 1987
Marvin Marcus and Moshe Goldberg 19 Jun. 1987 42 p
(Grant AF-AFOSR-0150-83)
(AD-A185824; AFOSR-87-1466TR) Avail: NTIS HC A03/MF A01 CSCL 12B

Two projects are described: (a) Stability criteria for difference approximations to hyperbolic systems, and multiplicativity of matrix norms; and (b) Problems in applied and computational linear algebra. The aim of these projects was to achieve better understanding of useful computational techniques for hyperbolic initial-boundary value problems, and to improve basic mathematical tools often used in numerical analysis and applied mathematics.
GRA

N88-15500# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE CLASSIFICATION PROBLEM OF FINITE RINGS BY COMPUTABLE MEANS Ph.D. Thesis
William A. Kiele 1987 140 p
(AD-A185869; AFIT/CI/NR-87-118T) Avail: NTIS HC A07/MF A01 CSCL 12A

This thesis establishes a constructive method for testing when two given finite rings are isomorphic. Currently published theory has classified a significant number of finite rings; however, idealized representatives are almost always used, with no provision for determining to which isomorphism class an arbitrary ring belongs. The new results are as follows: 1) Two rings are isomorphic if and only if a specific system of quadratic equations is satisfied; 2) As a corollary, there exists a system of linear equations that positively identify whether or not a ring R possesses a 1. The system also shows how to change a ring's basis so that 1 becomes a basis element. Some tests for existence of other idempotents besides 1 are shown; and 3) Some old and new results in classifying finite rings of small rank are obtained.
GRA

N88-15501# Brown Univ., Providence, R. I. Center for Dynamical Systems.
GLOBAL BIFURCATION OF PERIODIC SOLUTIONS WITH SYMMETRY
Bernold Fiedler Jul. 1987 148 p
(Grant AF-AFOSR-0376-84)
(AD-A185881; LCDS/CCS-87-29; AFOSR-87-1556TR) Avail: NTIS HC A07/MF A01 CSCL 12A

If we are given a dynamic system with some built-in symmetry, should we except periodic motions which somehow reflect this symmetry? And how would periodicity harmonize with symmetry? We are led from dynamics to topology algebra, singularity theory, numerical analysis, and to some applications. A global point of view is one guiding theme along the way: we are mainly interested in periodic motions far from equilibrium. For a method we rely on bifurcation theory, on transversality theory, and on generic approximations. As a reward we encounter known local singularities. As a central new aspect we study the global interaction and interdependence of these local singularities, designing a homotopy invariant. As a result, we obtain an index H which evaluates only information at stationary solutions. Nonzero H implies global Hopf bifurcation of periodic solutions with certain symmetries. Putting it emphatically, H harmonizes symmetry and periodicity. Curiously, H need not be homotopy invariant.
GRA

N88-15502# Texas Univ., Austin. Center for Cybernetic Studies.
EXPLICIT CONSTRUCTION AND ANALYSIS OF SOME EFFICIENT EMPIRICAL PRODUCTION FUNCTIONS IN DATA ENVELOPMENT ANALYSIS
A. Charnes, W. W. Cooper, D. B. Learner, F. Y. Phillips, and J. Rousseau Jun. 1987 18 p
(Contracts N00014-86-C-0398; N00014-82-C-0389; Grants NSF SES-84-08134; NSF SES-85-02806)
(AD-A185907; CCS-582) Avail: NTIS HC A03/MF A01 CSCL 12A

In contrast to classical econometric work which only tests data for consistency with a special class of production functions, new theory and explicit construction by Data Envelopment Analysis (DEA) of the empirical Pareto-Koopmans efficient production function is developed for data sets which satisfy two conditions met in all previous real applications of DEA. The construction requires no additional computation beyond that of the DEA tests. Section 2 compares differences in research in economic production theory with those of DEA. In section 3 basic concepts of and theorems for geometric elucidation and analysis of the empirical efficient production functions of DEA are developed including a new lemma on optimal solutions to the general linear programming problem (for arbitrary ordered fields of scalars). Then, restricting ourselves to two conditions on empirical data which have held in every DEA application made, it is shown that the mathematical structure of the efficient empirical function is so simplified that it is available immediately in analytical form without further computational work. The efficient empirical production is then , moreover, piece-wise linear and continuous from piece to piece.
GRA

N88-15503# Florida Univ., Gainesville. Dept. of Statistics.
THE EFFECT OF RESPONSE SCALING ON THE DETECTION OF SINGULARITIES IN MULTIRESPONSE ESTIMATION
Andre I. Khuri Sep. 1987 27 p
(Contract N00014-86-K-0059)
(AD-A185964; AD-F000114; TR-291) Avail: NTIS HC A03/MF A01 CSCL 12A

Box and Draper (1965) introduced a criterion for the estimation of parameters from a multiresponse model. This criterion can lead to misleading results in the presence of linear relationships among the responses. Box et al. (1973) proposed a procedure for detecting the existence of such relationships when the multiresponse data are subject to round-off errors. The procedure, however, can be adversely affected by large differences in the orders of magnitude of the responses as well as in the units of measurement on which the responses are expressed. It is, therefore, necessary to scale the responses prior to the application of that procedure. This document discusses the effect of scaling on the implementation of the eigenvalue analysis by Box et al. (1973). Two numerical examples are given for illustration.
GRA

N88-15504# California Univ., Berkeley. Operations Research Center.
AN O(n3L) INTERIOR POINT ALGORITHM FOR CONVEX QUADRATIC PROGRAMMING
R. C. Monteiro and I. Adler Jun. 1987 34 p
(Contract N00014-87-C-0202)
(AD-A186001; ORC-87-15) Avail: NTIS HC A03/MF A01 CSCL 12A

The authors describe a primal-dual interior point algorithm for convex quadratic programming problems which requires a total of O(cu n L) arithmetic operations. Each iteration updates a penalty parameter and finds an approximate Newton's direction associated with the Kuhn-Tucker system of equations which characterizes a solution of the logarithm barrier function problem. This direction is then used to find the next iterate. The algorithm is based on the path following idea. The total number of iterations is shown to be of the order of O (square root of n L). Author (GRA)

N88-15505# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
AN ELEMENTARY APPROACH TO THE DANIELL-KOLMOGOROV THEOREM AND SOME RELATED RESULTS Technical Report, Sep. 1986 - Sep. 1987
Olav Kallenberg Jun. 1987 25 p Prepared in cooperation with Auburn Univ., Ala.
(Contract F49620-85-C-0144)
(AD-A186011; TR-188; AFOSR-87-1104TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A short elementary proof is given of the Daniell Kolmogorov existence theorem for probability measures on product spaces, assuming nothing but the existence of Lebesgue measure on the unit interval. Related approaches are used to prove the existence of regular conditional distributions directly on Polish spaces, and to establish the existence of random measures and sets with given finite dimensional distributions or hitting probabilities, respectively. GRA

N88-15506# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
STOCHASTIC FILTERING SOLUTIONS FOR ILL-POSED LINEAR PROBLEMS AND THEIR EXTENSION TO MEASURABLE TRANSFORMATIONS Technical Report, Sep. 1984 - Sep. 1986
R. Brigola Mar. 1987 23 p Prepared in cooperation with Regensburg Univ., Fed. Republic of Germany
(Contract F49620-82-C-0009)
(AD-A186016; TR-180; AFOSR-87-1100TR) Avail: NTIS HC A03/MF A01 CSCL 12A

An ill-posed linear problem Ax=y in Hilbert space is considered as a filtering problem AX+Z=Y for Hilbert space valued random elements. Depending on the models for the signal X and the noise Z, the solutions of this problem are discussed in the context of cylinder measures on Hilbert spaces and their radification by the Abstract Wiener space concept. Extensions of the solutions to measurable transformations are given explicity. The filtering solution is related to the solution of the problem Ax=y obtained by Tichonov's regularization method. GRA

N88-15507# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
STRONG CONSISTENCY OF ESTIMATION OF NUMBER OF REGRESSION VARIABLES WHEN THE ERRORS ARE INDEPENDENT AND THEIR EXPECTATIONS ARE NOT EQUAL TO EACH OTHER
Yuehua Wu Jun. 1987 27 p
(Contract F49620-85-C-0008)
(AD-A186025; TR-87-15; AFOSR-87-1245TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This document considers the linear regression model y sub i = x sub i B + e sub i, i = 1, 2, ..., where (x sub i) - is a sequence of known p-vectors, Beta = (Beta Sub 1, ..., Beta Sub p) is an unknown p-vector, known as regression coefficients, (e Sub i) is a sequence of random errors. It is of interest to test the hypothesis H Sub k: Beta Sub k+1 = ... = Beta Sub p = O, k = O, 1,...,p. We do not assume that the random errors are identically distributed and have zero means, since it is sometimes realistic. As a compensation for this relaxation, we assume the errors have a common bounded support A Sub 1, a Sub 2 under certain conditions, we obtain the strongly consistent estimate of the number k for which Beta Sub k is not equal to O and Beta Sub k+1 = ... = Beta Sub p = O, by using the information theoretical criteria. GRA

N88-15508# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON THE LEAST SQUARES ESTIMATOR IN MOVING AVERAGE MODELS OF ORDER ONE
H. A. Chapeh and M. B. Rao Dec. 1986 13 p
(Contracts F49620-85-C-0008; N00014-85-K-0292)
(AD-A186028; TR-86-45; AFOSR-87-1015TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A simple expression is derived in this paper for the error sum of squares in the context of moving average models of order one. A computer program is developed to estimate the parameter of a moving average model of order one based on the method of least squares. GRA

N88-15509# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
DETECTING AND INTERVAL ESTIMATION ABOUT A SLOPE CHANGE POINT
P. R. Krishnaiah and B. Q. Miao Jun. 1987 30 p
(Contract F49620-85-C-0008)
(AD-A186030; TR-87-11; AFOSR-87-0974TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of change points is considered using Gaussian process. The distribution of the statistic to estimate a change point constructed in this paper can be approximated by the first type of extrimal distribution. Based on this, detection and interval estimation of a change point in various situations are discussed. GRA

N88-15510# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
A NEW METHOD OF ESTIMATION IN A MOVING AVERAGE MODEL OF ORDER ONE
H. A. Chapeh and M. B. Rao Dec. 1986 18 p
(Contracts F49620-85-C-0008; N00014-85-K-0292)
(AD-A186039; TR-86-46; AFOSR-87-1091TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The exact likelihood of the data coming from a moving average model of order is complicated. In this paper, the authors propose a method of estimation of the parameters of a moving average model of order one based on the approximate likelihood of the data and on the simulation of a pair of random variables. Some comparisons were made of this method with some well known methods for moderate sample sizes. A computer program is appended which is helpful in using this method. GRA

N88-15511# Indiana Univ., Bloomington. Dept. of Computer Science.
SEARCH REARRANGEMENT BACKTRACKING OFTEN REQUIRES EXPONENTIAL TIME TO VERIFY UNSATISFIABILITY
John Franco 5 Jul. 1987 29 p
(Grant AF-AFOSR-0372-84)
(AD-A186121; AFOSR-87-1153TR) Avail: NTIS HC A03/MF A01 CSCL 12A

It is shown that any form of Search Rearrangement Backtracking (SRB) requires exponential time to verify the unsatisfiability of nearly all of a wide class of CNF boolean expressions. This result is based on an input model which generates n independant k-literal clauses from set of r boolean variables. We assume that k is fixed and n and r tend to infinity. The result holds if the limit as n approaches infinity of n/r(n) = lambda, is fixed and lambda is greater than 1n(2)/(1-2 to the -K power). SRB requires superpolynomial time nearly always if lambda is replaced by

lambda(n) = o(n to the 1/ln ln (n) power and the limit as n approaches infinity of lambda (n) = infinity (so the superpolynomial time result holds, for example if lambda (n) = (ln(n)) to the beta power where beta is any positive constant) These results apply to any form of the Davis-Putnam Procedure. GRA

N88-15512# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
BOUNDING THE EXPECTATION OF CONVEX FUNCTIONS WITH LIMITED DISTRIBUTION INFORMATION
John R. Birge and Jose H. Dula 1987 23 p
(Contract N00014-86-K-0628; Grant NSF-ECS-83-04065)
(AD-A186147; TR-87-15) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper considers bounds on the expectation of a convex function of a random variable when only limited information is available about the underlying distribution. The problem is presented as a generalized moment problem. A special class of functions is shown to have an easily computable solution to this problem with first and second moment constraints. Extensions are given for general convex functions on finite intervals or with finitely valued recession functions. GRA

N88-15513# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
STRONG LAWS OF LARGE NUMBERS FOR ARRAYS OF ORTHOGONAL RANDOM VARIABLES Technical Report, 1 Oct. 1986 - 30 Sep. 1987
F . Moricz and R. L. Taylor Dec. 1986 17 p
(Contract F49620-85-C-0144)
(AD-A186159; TR-174; AFOSR-87-1001TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This document describes Hilbert Space Valued Random Variables. GRA

N88-15514# Maryland Univ. Baltimore County, Catonsville. Dept. of Mathematics.
ON THE CONVERGENCE OF THE p-VERSION OF THE BOUNDARY ELEMENT GALERKIN METHOD Summary Report
E. P. Stephan and M. Suri 14 Jul. 1987 35 p
(Grant AF-AFOSR-0322-85)
(AD-A186198; AFOSR-87-1046TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The authors consider various physical problems which may be formulated in terms of integral equations of the first kind, including the two-dimensional screen Neumann and Dirichlet problems in acoustics (and crack problems in elasticity). Sharp regularity results for the solutions are available for these problems. Proven is the convergence of the p-version for some Galerkin boundary element schemes based on the integral equation formulations. It is shown that the rate of convergence obtained by our method is twice that for the usual h-version. GRA

N88-15515# Tennessee Univ., Knoxville. Dept. of Mathematics.
SPECTRAL REPRESENTATION OF INFINITELY DIVISIBLE PROCESSES Interim Report
Balram S. Rajput and Jan Rosinski May 1987 51 p
(Grant AF-AFOSR-0136-87)
(AD-A186210; AFOSR-87-0985TR) Avail: NTIS HC A04/MF A01 CSCL 12A

The spectral representations for arbitrary discrete parameter infinitely divisible processes as well as for (centered) continuous parameter infinitely divisible processes, which are separable in probability, are obtained. The main tools used for the proofs are (1) a polar-factorization of an arbitrary Levy measure on a separable Hilbert space, and (2) the Wiener-type stochastic integrals of non-random functions relative to arbitrary infinitely divisible noise . GRA

N88-15516# Florida Univ., Gainesville. Dept. of Mathematics.
GREEN'S FUNCTION FOR A BALL
K. L. Chung 1986 8 p
(Grant AF-AFOSR-0330-85)
(AD-A186239; AFOSR-87-1113TR) Avail: NTIS HC A02/MF A01 CSCL 12A

We obtain a new sharp inequality for the Green's function of Brownian motion on a ball. GRA

N88-15517# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
UPPER BOUNDS ON THE EXPECTED VALUE OF A CONVEX FUNCTION USING GRADIENT AND CONJUGATE FUNCTION INFORMATION
John R. Birge and Marck Teboulle Aug. 1987 30 p
(Contract N00014-86-K-0628)
(AD-A186246; TR-87-19) Avail: NTIS HC A03/MF A01 CSCL 12A

New upper bounds are given for the expected value of a convex function. The bounds employ subgradient information and the conjugate function. The bounds are derived and compared with previous bounds with different information requirements. GRA

N88-15518# California Univ., Riverside. Dept. of Statistics.
ON TWO METHODS OF IDENTIFYING INFLUENTIAL SETS OF OBSERVATIONS Interim Report, Dec. 1986 - Feb. 1987
Subir Ghosh Feb. 1987 13 p
(Grant AF-AFOSR-0048-87)
(AD-A186270; TR-152; AFOSR-87-1244TR) Avail: NTIS HC A03/MF A01 CSCL 12A

In this paper two new measurements are proposed to identify influential sets of observations at the design state in view of prediction and fitting. A relationship is established between one of proposed measures and the Cook's measure at the inference stage. GRA

N88-15519# Yale Univ., New Haven, Conn.
LOCAL UNIFORM MESH REFINEMENT FOR PARTIAL DIFFERENTIAL EQUATIONS Final Report
William Gropp Jul. 1987 4 p
(Grant AF-AFOSR-0360-84)
(AD-A186312; AFOSR-87-1267TR) Avail: NTIS HC A02/MF A01 CSCL 12A

Several aspects of adaptive methods for partial differential equations implemented on vector and parallel computers were investigated in this effort. A new technique for mapping mesh points to processors in a static way has been developed, taking advantage of the structure of the family of solutions without singling out any one solution. Three publications and two technical reports resulted from this effort, as well as two conference proceedings papers and four presentations. Papers included the following titles: A comparison of domain decomposition techniques for elliptic partial differential equations and their parallel implementation; Local uniform mesh refinement on loosely-complied parallel processors; and Dynamic grid manipulation for partial differential equations on hypercube parallel processors. Author (GRA)

N88-15520# Wisconsin Univ., Madison. Dept. of Computer Sciences.
THE k-GRID FOURIER ANALYSIS OF MULTIGRID-TYPE ITERATIVE METHODS Final Report
Naomi H. Decker Jul. 1987 65 p
(Grants AF-AFOSR-0275-82; AF-AFOSR-0163-86)
(AD-A186315; TR-703; AFOSR-87-1268TR) Avail: NTIS HC A04/MF A01 CSCL 12A

Experiments indicate that a multigrid-type cycle can be used as an efficient preconditioner in the iterative solution of the discrete problem corresponding to a singularly perturbed elliptic boundary value problem. Motivated by a report of Goldstein, we explore the theoretical basis for the efficiency of such a preconditioner when applied to a model problem. The techniques developed are also used to analyze a multigrid V-cycle when used alone as a fast iterative solver. Author (GRA)

N88-15521# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON THE EXTREME POINTS OF THE SET OF ALL 2xn BIVARIATE POSITIVE QUADRANT DEPENDENT DISTRIBUTIONS WITH FIXED MARGINALS AND SOME APPLICATIONS
K. Subramanyam and M. Bhaskara Rao Jun. 1987 25 p
(Contract F49620-85-C-0008)
(AD-A186316; TR-87-13; AFOSR-87-1118TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The set of all bivariate distributions with support contained in ((i,j); i = 1,2 and j = 1,2...,n), which are positive quadrant dependent, is a convex set. An algebraic method is presented for the enumeration of all extreme points of this convex set. Certain measures of dependence, including Kendall's tau, are shown to be affine functions on this convex set. This property of being affine helps us to evaluate the asymptotic power of tests based on these measures of dependence for testing the hypothesis of independence against strict positive quadrant dependence. GRA

N88-15522# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ESTIMATION AND TESTING IN TRUNCATED AND NONTRUNCATED LINEAR MEDIAN-REGRESSION MODELS
X. R. Chen and P. R. Krishnaiah Dec. 1986 41 p
(Contract F49620-85-C-0008)
(AD-A186317; TR-86-50; AFOSR-87-1089TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A number of important recent advances in econometric theory are related to the methods of the truncated regression model - the regression model in which the range of the dependent variable is restricted to some interval of (-infinity, infinity), usually the non-negative half-line, such as the income of an individual. Powell used the L sub 1-norm criterion with some modifications in estimating the regression coefficients in truncated linear models. He proved the consistency and asymptotic normality of his estimates under a set of conditions. On the other hand, Nawata's paper uses the ordinary L sub 2-norm (least square) criterion, along with a grouping and adjustment of the observed data. In his view, his method has the merit of easy computation compared with the method of Powell. This paper borrows the basic idea of Nawata in grouping and adjusting the observed data. But the authors make simplifications in the procedure of grouping, which enables us to make substantial extensions of the results of Nawata's paper under weakened conditions. GRA

N88-15523# Maryland Univ. Baltimore County, Catonsville. Dept. of Mathematics.
THE P-VERSION OF THE FINITE ELEMENT METHOD FOR ELLIPTIC EQUATIONS OF ORDER 2L Summary Report
21 Jul. 1987 42 p
(Grant AF-AFOSR-0322-85)
(AD-A186334; AFOSR-87-1053TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The finite element method has three versions: the h-version, the p-version and the h-p version. In the h-version, increased accuracy is achieved by decreasing the mesh size h while keeping p, the degree of elements used fixed (usually p = 1,2,3). In the p-version, a fixed mesh is used while the degree p of elements are either uniformly or selectively increased to achieve accuracy. The h-p version is a combination of both. The standard h-version has been thoroughly investigated and many commercial and research programs are available. The p- and h-p versions are recent developments. There is only one commercial code, the system PROBE, and the first papers discussing theoretical aspects appeared only in 1981. The approximations of solutions of elliptic problems of order 21 over two - dimensional polygonal domains by the p-version of the finite element is investigated. Optimal rates of convergence are established for the case when elements possessing C continuity are used. GRA

N88-15524# Florida State Univ., Tallahassee. Dept. of Statistics.
PARAMETER ESTIMATION FOR THE DIRICHLET-MULTINOMIAL DISTRIBUTION (DMD) USING SUPPLEMENTARY BETA-BINOMIAL DATA
Peter J. Danaher Jul. 1987 13 p
(Contract F49620-85-C-0007)
(AD-A186335; FSU-STATISTICS-M761; AFOSR-87-1084TR)
Avail: NTIS HC A03/MF A01 CSCL 12A

Estimates are developed for the parameters of Dirichlet-multinomial distribution (DMD) when there is insufficient data to obtain maximum likelihood or method of moment estimates known in the literature. We do, however, have supplementary beta-binomial data pertaining to the marginals of the DMD, and use these data when estimating the DMD parameters. A real situation and data set are given where the estimates are applicable. GRA

N88-15525# South Carolina Univ., Columbia. Dept. of Statistics.
A MODIFIED KERNEL QUANTILE ESTIMATOR UNDER CENSORING
Y. L. Lio and W. J. Padgett Mar. 1987 18 p
(Grant AF-AFOSR-0156-84)
(AD-A186364; TR-125; AFOSR-87-1247TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Based on right censored data from a lifetime distribution F sub 0, a modification of the kernel quantile estimator is proposed. The advantage of this estimator is that the data play a role in the degree of smoothing of the estimator while retaining the desireable features of the kernel estimator. Convergence in probability and almost sure convergence of the estimator are discussed. Some examples are given which illustrate the differences between this modified estimator and the fixed-bandwidth kernel quantile estimator for randomly right-censored data. GRA

N88-15526# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
STRONG CONSISTENCY OF MAXIMUM LIKELIHOOD PARAMETER ESTIMATION OF SUPERIMPOSED EXPONENTIAL SIGNALS IN NOISE
Z. D. Bai, X. R. Chen, P. R. Krishnaiah, Y. H. Wu, and L. C. Zhao Jun. 1987 21 p
(Contract F49620-85-C-0008)
(AD-A186384; TR-87-17; AFOSR-87-0973TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Consider the model of multiple superimposed exponential signals in additive Gaussian noise yj(t) = (sigma i= 1 to p)sij (lambda sub i) to the t power + ej(t), t = 0,1,...,n-1, j = 1,...,N. GRA

N88-15527# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
THE INFORMATION METRIC FOR UNIVARIATE LINEAR ELLIPTIC MODELS
Jacob Burbea and Jose M. Oller Jun. 1987 21 p
(Contract F49620-85-C-0008)
(AD-A186385; TR-87-20; AFOSR-87-0978TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The concepts of metrics and distances are fundamental in problems of statistical inference and in practical applications to study affinities among a given set of populations. A statistical model is specified by a family of probability distributions, described by a set of continuous parameters known as the parameter space. This model possesses some geometrical properties which are induced by the local information matrix of the given family of distributions giving rise to a Riemannian metric over the parameter space, whose geodesic distance, known as the Rao distance, plays a major role in the multivariate statistical techniques. For the family of multivariate normal distributions with fixed shape but varying locations, this distance reduces the well-known Mahalanobis distance. This document refers to Burbea and Rao for more details on these concepts and their derivations. An

interesting statistical model is provided by the family of elliptic distributions whose density functions have elliptical contours and which include the multivariate normal distributions as a subfamily. This paper studies the information metric associated with an elliptic family whose shape varies linearly. GRA

N88-15528# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ESTIMATION OF MULTIVARIATE BINARY DENSITY USING ORTHONORMAL FUNCTIONS
X. R. Chen, P. R. Krishnaiah, and W. Q. Liang Dec. 1986 17 p
(Contract F49620-85-C-0008)
(AD-A186386; TR-86-48; AFOSR-87-1075TR) Avail: NTIS HC A03/MF A01 CSCL 12A

In a number of situations, the experimenter is confronted with the statistical analysis of the data which is binary in nature. For example, one may be interested in diagnosis of the disease on the basis of symptoms. The reliability of complicated systems can be studied by examining as to whether its components are functioning or not. In image processing, a picture is classified on the basis of two grey levels like white and black using some threshold value. We may assign a score of 1 or 0 according as the grey level is white or black respectively. So, it is important to study the problems of estimation of multivariate binary density. Cencov expressed continuous multivariate density as a series of orthonormal functions. Bahadur expressed the multivariate binary density as a series. Ott and Kronmal expressed the density as a series involving Walsh functions. Liang and Krishnaiah also expressed the density in terms of Walsh functions but the coefficients in their series are different from those used by Ott and Kronmal. This paper is a continuation of the work done by Liang and Krishnaiah. GRA

N88-15529# North Carolina Univ., Chapel Hill. Dept. of Statistics.
WEAK CONVERGENCE OF SUMS OF MOVING AVERAGES IN THE ALPHA-STABLE DOMAIN OF ATTRACTION Technical Report, Sep. 1986 - Aug. 1987
Florin Avram Jun. 1987 30 p
(Contract F49620-85-C-0144)
(AD-A186430; TR-191; AFOSR-87-1087TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Skorohod has shown that the convergence of sums of i.i.d. random variables to an alpha-stable Levy process, with 0 less than alpha less than 2, holds in the weak J sub 1 sense. It is shown that for sums of moving averages with at least 2 non-zero coefficients, weak J sub 1 convergence cannot hold; however, if the moving average coefficients are positive, weak M sub 1 convergence usually does hold. GRA

N88-15530# North Carolina Univ., Chapel Hill. Dept. of Statistics.
LOCAL PROPERTIES OF INDEX-ALPHA STABLE FIELDS Technical Report, 1 Oct. 1986 - 30 Sep. 1987
John P. Nolan Dec. 1986 22 p
(Contract F49620-85-C-0144)
(AD-A186432; TR-171; AFOSR-87-1059TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The paths of the stable fields that are the analogs of index-beta Gaussian fields are examined. Holder conditions are found on their paths and the Hausdorff dimension of the image, graph, and level sets is found when we have local nondeterminism, generalizing the Gaussian results. GRA

N88-15531# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
ALGEBRAIC SPECIFICATION OF PROCESS ALGEBRA, INCLUDING TWO EXAMPLES
S. Mauw Feb. 1987 58 p
(PB88-106729; FVI-87-06) Avail: NTIS HC A04/MF A01 CSCL 12A

The possibilities to describe process algebra as an algebraic specification are studied. Two examples from the field of the specification of communication protocols are discussed to analyze the adequacy of the approach in practical situations. GRA

N88-15532# Groningen Rijksuniversiteit (Netherlands). Wiskunde en Informatica.
CHARACTERIZATION OF ALL CONTROLLED INVARIANT SUB-SPACES FOR SPECTRAL SYSTEMS
H. Zwart 1986 39 p Sponsored by Nederlandse Organisatie voor Zuiver Wetenschappelijk Onderzoek, The Hague
(PB88-106638; TW-271) Avail: NTIS HC A03/MF A01 CSCL 12A

For a class of spectral systems a complete characterization of all controlled invariant subspace contained in a closed subspace will be given. This characterization is given in terms of the invariant zeros of the transfer function. As a consequence, necessary and sufficient conditions were derived for the existence of U (KerC), the largest controlled invariant subspace in the kernel of C. GRA

N88-15533# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
ANNOTATED ALGEBRAIC SPECIFICATION OF THE STATIC SEMANTICS OF POOL
H. R. Walters Sep. 1986 39 p
(PB88-106695; FVI-86-20) Avail: NTIS HC A03/MF A01 CSCL 12A

A specification of the abstract syntax and context dependent grammar of the programming language POOL is given. Various aspects of this specification and of the algebraic formalism are discussed. GRA

N88-15534# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
CORRECTNESS PROOFS FOR SYSTOLIC ALGORITHMS: PALINDROMES AND SORTING
L. Kossen and W. P. Weijland Feb. 1987 46 p
(PB88-106075; FVI-87-04) Avail: NTIS HC A03/MF A01 CSCL 12A

In designing VLSI circuits it is very useful, if not necessary, to construct the specific circuit by placing simple components in regular configurations. Systolic systems are circuits built up from arrays of cells and therefore very suitable for formal analysis and induction methods. In two examples correctness proofs are given using bisimulation semantics with asynchronous communication. These examples also have been worked out by Hennessy in a setting of failure semantics with synchronous communication. Finally, the notion of process creation is introduced and used to construct machines with unbounded capacity. GRA

N88-15535# Lawrence Livermore National Lab., Calif.
RECENT DEVELOPMENTS IN THE NUMERICAL SOLUTION OF DIFFERENTIAL/ALGEBRAIC SYSTEMS
L. R. Petzold Oct. 1987 20 p Presented at the 8th International Conference on Computing Methods in Applied Mechanics, Versailles, France, 14 Dec. 1987
(Contract W-7405-eng-48)
(DE88-001885; UCRL-97517; CONF-871230-1) Avail: NTIS HC A03/MF A01

Some recent development are surveyed in the numerical solution of nonlinear differential/algebraic equation (DAE) systems of the form O = F(t,y,y'), where par. delta F/par. delta y' may be singular. Initial value problems in DAEs arise in a wide variety of applications, including circuit and control theory, chemical kinetics, modeling of constrained mechanical systems, fluid dynamics and robotics. DAE systems include standard form ODEs as a special case, but they also include problems which are in many ways quite different from ODEs. We explore some classes of initial value problems which can be solved by backward differentiation formulas, and discuss some results on the order of convergence of implicit Runge-Kutta methods applied to DAE systems. Finding a consistent set of initial conditions is often a problem for DAE

systems arising in applications. We outline some recent work on a general algorithm for finding consistent initial conditions. Finally, we discuss some new developments in the numerical solution of DAE boundary value problems. DOE

N88-15536*# Hampton Inst., Va. Dept. of Mathematics.
SPECTRAL DILATION OF L(B,H)-VALUED MEASURES AND ITS APPLICATION TO STATIONARY DILATION FOR BANACH SPACE VALUED PROCESSES
A. G. Miamee [1988] 27 p
(Grant NAG1-768)
(NASA-CR-182388; NAS 1.26:182388) Avail: NTIS HC A03/MF A01 CSCL 12A

Let B be a Banach space and H and K two Hilbert spaces. The spectral dilation of L(B,H)-valued measures is studied and it is shown that the recent results of Makagon and Salehi (1986) and Rosenberg (1982) on the dilation of L(K,H)-valued measures can be extended to hold for the general Banach space setting of L(B,H)-valued measures. These L(B,H)-valued measures are closely connected to the Banach space valued processes. This connection is recalled and as application of spectral dilation of L(B,H)-valued measures the well known stationary dilation results for scalar valued processes is extended to the case of Banach space valued processes. Author

N88-15537# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
NONSYMMETRIC METRICS IN NONLINEAR FIELD THEORY
N. S. Shavokhina 1986 7 p In RUSSIAN
(DE88-700509; JINR-R-2-86-685) Avail: NTIS (US Sales Only) HC A02/MF A01

Algebraic and differential properties are considered of a nonsymmetric metrics introduced into field theory by Einstein and subsequently by Born and Infeld. It is shown that the nonsymmetric metrics is characterized by a pair of vector and a pair of covector fields connected by two identities. If these fields are zero, the nonsymmetric metrics is called harmonic; an example is any metrics obeying the Born-Infeld equations. The theory of harmonic metrics may be considered as a direct generalization of the Born-Infeld theory. DOE

N88-15636*# Auburn Univ., Ala. Dept. of Algebra, Combinatorics and Analysis.
THE JEFFCOTT EQUATIONS IN NONLINEAR ROTORDYNAMICS
R. A. Zalik *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 37 p (For primary document see Summer Faculty Fellowship Program 37 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N88-15538# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
STATISTICAL SELECTION PROCEDURES Final Report, 15 Feb. 1986 - 13 Aug. 1987
Robert E. Bechhofer 22 Sep. 1987 8 p
(Contract DAAL03-86-K-0046)
(AD-A185868; ARO-23198.6-MA) Avail: NTIS HC A02/MF A01 CSCL 12A

The main emphasis of recent research on this contract has been the study of 1) statistical selection procedures for multi-factor experiments; and 2) truncation of sequential selection procedures. GRA

N88-15539# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE PERFECTLY MATCHABLE SUBGRAPH POLYTOPE OF AN ARBITRARY GRAPH
Egon Balas and William R. Pulleyblank Aug. 1987 27 p
(Contract N00014-85-K-0198; Grant NSF ECS-86-01660)
(AD-A185993; MSRR-538) Avail: NTIS HC A03/MF A01 CSCL 12A

The Perfectly Matchable Subgraph Polytope of a graph G=(V,E), denoted by PMS (G) is the convex hull of the incidence vectors of the X is a subset of V which induce a subgraph having a perfect matching. A linear system is described, whose solution set is PMS (G), for a general (nonbipartite) graph G. It can be derived via a projection technique from Edmonds' characterization of the matching polytope of G. This system can be deduced from the earlier bipartite case, by using the Edmonds- Gallai structure theorem. GRA

N88-15540# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
DECOUPLING IDENTITIES AND PREDICTABLE TRANSFORMATIONS IN EXCHANGEABILITY Technical Report, Sep. 1986 - Sep. 1987
Olav Kallenberg Jun. 1987 50 p Prepared in cooperation with Auburn Univ., Ala.
(Contract F49620-85-C-0144)
(AD-A186013; TR-187; AFOSR-87-1108TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Let X=(X1,...,Xd) and V=(V1,...,Vd) be processes on (0,1) or R+, such that X is exchangeable while Vd is predictable. Under suitable conditions on X and V, the expression E(pi) Integral over j of (V sub j dX sub j) will only depend on the marginal distributions of X and V. From statements of this type in discrete or continuous time, one may easily derive a variety of old and new results on predictable transformations which preserve the distribution of an exchangeable sequence or process. The same method yields a general result about reduction of continuous local martingales and marked point processes to independent Gaussian and Poisson random fields. GRA

N88-15541# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
REMARK ON THE MULTIPLE WIENER INTEGRAL Technical Report, Sep. 1985 - Sep. 1986
R. Brigola Mar. 1987 10 p Prepared in cooperation with Regensburg Univ., Fed. Republic of Germany
(Contract F49620-82-C-6448)
(AD-A186015; TR-179; AFOSR-87-1099TR) Avail: NTIS HC A02/MF A01 CSCL 12A

A short proof is given for Ito's result that the multiple Wiener integral can be written as an iterated stochastic integral, using the martingale property of Brownian motion and a simple property of symmetric tensor products of the L squared - space. Author (GRA)

N88-15542# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
POINT PROCESSES IN THE PLANE Technical Report, Oct. 1986 - Sep. 1987
Ely Merzbach Feb. 1987 40 p Prepared in cooperation with Bar-Ilan Univ., Ramat-Gan, Israel
(Contract F49620-85-C-0144)
(AD-A186017; TR-176; AFOSR-87-1095TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Two-parameter point processes are studied in connection with martingale theory and with respect to the partial-order induced by the Cartesian coordinates of the plane. Point processes are characterized by jump stopping times and by their two-parameter compensators. Properties of the doubly stochastic Poisson process, as predictability, are discussed. A definition for the Palm measure of a two-parameter stationary point process is proposed. GRA

N88-15543# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON SIMULTANEOUS ESTIMATION OF THE NUMBER OF SIGNALS AND FREQUENCIES UNDER A MODEL WITH MULTIPLE SINUSOIDS

Z. D. Bai, P. R. Krishnaiah, and L. C. Zhao Dec. 1986 35 p
(Contracts F49620-85-C-0008; N00014-83-K-0387)
(AD-A186026; TR-86-37; AFOSR-87-1016TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of estimation of the frequencies and the number of signals under a signal processing model with multiple sinusoids is considered. The frequencies are estimated with an eigenvariation linear prediction method. The number of signals is estimated with an information theoretic criterion. The strong consistency of the estimates of the frequencies and the number of signals is also established. Also, a modification of forward backward linear prediction method is suggested to yield consistent estimators of the frequencies. GRA

N88-15544# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
MAXIMUM LIKELIHOOD PRINCIPLE AND MODEL SELECTION WHEN THE TRUE MODEL IS UNSPECIFIED
Ryuei Nishii Feb. 1987 18 p
(Contract F49620-85-C-0008)
(AD-A186027; TR-87-01; AFOSR-87-1017TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Suppose independent observations come from an unspecified distribution. Then we consider the maximum likelihood based on a specified parametric family by which we can approximate the true distribution well. We examine the asymptotic properties of the quasi-maximum likelihood estimate and of the quasi-maximum likelihood. These results will be applied to model selection problem. GRA

N88-15545# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
NONPARAMETRIC ESTIMATION OF THE GENERALIZED VARIANCE
Bimal K. Sinha and Pranab K. Sen Nov. 1986 15 p
(Contracts F49620-85-C-0008; N00014-83-K-0387)
(AD-A186029; TR-86-36; AFOSR-87-1019TR) Avail: NTIS HC A03/MF A01 CSCL 12A

For multivariate distributions with finite second order moments, a nonparametric symmetric, unbiased estimator of the generalized variance is considered, and it is shown to be (nonparametric) optimal for the class of distributions having finite fourth order moments. A jackknifed version of the sample generalized variance is also considered as a contender; it is computationally more convenient and asymptotically equivalent to the former. It is also shown that the second estimator performs quite well (in large sample) relative to the optimal normal theory estimators under several loss functions. GRA

N88-15546# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON THE DIRECTION OF ARRIVAL ESTIMATION
Z. D. Bai, P. R. Krishnaiah, and L. C. Zhao Jun. 1987 30 p
(Contracts F49620-85-C-0008; N00014-85-K-0292)
(AD-A186031; TR-87-12; AFOSR-87-1110TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The estimation of arrival direction is an important task in signal processing and has recently received considerable attention in the literature. In this paper, the authors proposed a method to estimate the direction of arrival and proved the strong consistency of the estimates for both cases in presence of white noise and colored noise. GRA

N88-15547# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
VARIABLE SELECTION IN LOGISTIC REGRESSION
Z. D. Bai, P. R. Krishnaiah, and L. C. Zhao Jun. 1987 20 p
(Contract F49620-85-C-0008)
(AD-A186032; TR-87-23; AFOSR-87-1074TR) Avail: NTIS HC A03/MF A01 CSCL 12A

In many situations, we are interested in selection of important variables which are adequate for prediction under a logistic regression model. In this paper, some selection procedures based on the information theoretic criteria are proposed, and these procedures are proved to be strongly consistent. GRA

N88-15548# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
STRATEGIES OF DATA ANALYSIS
C. R. Rao Jun. 1987 22 p
(Contract F49620-85-C-0008)
(AD-A186033; TR-87-14; AFOSR-87-1088TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The purpose of statistical analysis is to extract all the information from observed data.. The recorded data may have some detects such as recording errors and outliers and the first task of a statistician is to scrutinize or cross-examine the data for possible defects and understand its special features. The next step is the specification of a suitable stochastic model for the data using prior information and cross-validation techniques. On the basis of a chosen model, inferential analysis is made, which comprises estimation of unknown parameters, tests of hypotheses, prediction of future observations and decision making. Examining data under different possible models is suggested as more informative than using robust procedures to safeguard against possible alternative models. Finally data analysis must also provide information for raising new questions and planning future investigations. Some aspects of data analysis as outlined above are illustrated through examples. GRA

N88-15549# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON RATE OF CONVERGENCE OF EQUIVARIATION LINEAR PREDICTION ESTIMATES OF THE NUMBER OF SIGNALS AND FREQUENCIES OF MULTIPLE SINUSOIDS
Z. D. Bai, P. R. Krishnaiah, and L. C. Zhao Dec. 1986 14 p
(Contracts F49620-85-C-0008; N00014-85-K-0292)
(AD-A186034; TR-86-38; AFOSR-87-1018TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Investigated are rates of convergence of estimates of frequencies and the number of signals under a signal processing model with multiple sinusoids. GRA

N88-15550# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
NECESSARY AND SUFFICIENT CONDITIONS FOR THE CONVERGENCE OF INTEGRATED AND MEAN-INTEGRATED r-th ORDER ERROR OF HISTOGRAM DENSITY ESTIMATES
X. R. Chen and L. C. Zhoa Apr. 1987 17 p
(Contract F49620-85-C-0008)
(AD-A186037; TR-87-07; AFOSR-87-1126TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Suppose that X sub 1,...,X sub n are iid. samples drawn from a d-dimensional population with density function f. Let f(x) sub n = f sub n sub (x;X sub 1,....,X sub n) be an estimator of f(x). The Integrated Square Error (ISE) and Mean Integrated Square Error (MISE) of f sub n are important and widely used criteria in evaluating the performance of an estimator f sub n. Quite a lot of works appeared in the statistical literature dealing with the asymptotic properties of them, for various types of estimators, such as kernel estimator, orthogonal series estimator, nearest neighbor estimator etc. The authors describe the necessary and sufficient conditions for the histogram estimator. GRA

N88-15551# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
SOME NEW APPROACHES TO MULTIVARIATE PROBABILITY DISTRIBUTIONS
D. N. Shanbhag and S. Kotz Dec. 1986 38 p
(Contract F49620-85-C-0008)
(AD-A186038; TR-86-44; AFOSR-87-1094TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper extends to and generalizes on the multivariate set-up earlier investigations related to expected remaining life functions and general hazard measures including representations and stability

theorems for arbitrary probability distributions in terms of these concepts. Author (GRA)

N88-15552# South Carolina Univ., Columbia. Dept. of Statistics.
A SMOOTH NONPARAMETRIC QUANTILE ESTIMATOR FROM RIGHT-CENSORED DATA
W. J. Padgett and L. A. Thombs May 1987 25 p
(Grants AF-AFOSR-0156-84; MIPR-ARO-139-85)
(AD-A186180; TR-127; AFOSR-87-1321TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Based on randomly right-censored data, a smooth nonparametric estimator of the quantile function of the lifetime distribution is studied. The estimator is defined to be the solution x sub n (p) to F sub n (x sub n (p)) = O, where F sub n is the distribution function corresponding to a kernel estimator of the lifetime density. The strong consistency and asymptotic normality of x sub n (p) are shown. Some simulation results comparing this estimator with the product of the bandwidth required for computing F sub n is investigated using bootstrap methods. Illustrative examples are given. Author (GRA)

N88-15553# South Carolina Univ., Columbia. Dept. of Statistics.
ON DETERMINING THE WEIGHT FOR OBTAINING A LARGE NUMBER OF ITEMS
Kai F. Yu Mar. 1987 18 p
(Grant AF-AFOSR-0156-84)
(AD-A186181; TR-126; AFOSR-87-1150TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A simple procedure is proposed to determine a sample size for estimating the mean weight of items in a problem of obtaining a batch of a large number of items. Suppose it is desired to obtain a large number N(sub s) of items for which individual counting is impractical, but one can demand a batch to weigh at least w units and hope that the number of items in the batch is close to the desired number N(sub s). If the items have mean weight theta, it is reasonable to have w equal to theta N sub s when theta is known. When theta is unknown, one can take a sample of size n, not bigger than N(sub s), estimate theta by a good estimator theta sub n and set w equal to theta(sub n) N(sub s). The proposed procedure determines the sample size to be the integer closest to rho CN sub s, where C is a function of the cost coefficients if the coefficient of variation rho is known. It is shown to be optimal in some sense. If rho is unknown, a simple sequential procedure is proposed for which the average sample number is shown to be asymptotically equal to the optimal fixed sample size. When the weights are assumed to have a gamma distribution given theta and theta has a prior inverted gamma distribution, the optimal sample size in some sense can be found to be the nonnegative integer closest to rho CN sub s + rho squared A(rho C-1), where A is a known constant given in the prior distribution. GRA

N88-15554# Columbia Univ., New York, N.Y.
ON STOCHASTIC OPTIMALITY OF POLICIES IN FIRST PASSAGE PROBLEMS
Michael N. Katehakis and Costis Melolidakis 1987 15 p
(Grants AF-AFOSR-0072-87; NSF DMS-84-05413)
(AD-A186293; AFOSR-87-1254TR) Avail: NTIS HC A03/MF A01 CSCL 12A

In stochastic scheduling and optimal maintenance problems that have been considered in the literature, the optimization criterion used has often been equivalent to minimizing the expected first passage times to a set of states. A typical method used in establishing the optimality of a certain policy is the method of successive approximations on the appropriate dynamic programming functional equations. As an intermediate result, this technique often involves, the optimality of the pertinent policy for all finite horizon versions of the problem. This paper characterizes stochastically optimal policies as policies that process a similar property, i.e., they are optimal in expectation for all members of a sequence of appropriately defined finite horizon problems. The authors use this characterization to establish the stochastic optimality of relevant policies for the optimal repair allocation for a series system problem and for a scheduling problem. Author (GRA)

N88-15555# North Carolina Univ., Chapel Hill. Dept. of Statistics.
A NOTE ON EXTENDED QUASI-LIKELIHOOD Technical Report, Aug. 1986 - Aug. 1987
Marie Davidian and R. J. Caroll Feb. 1987 17 p
(Contract F49620-85-C-0144)
(AD-A186318; MMS-1716; AFOSR-87-1132TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The authors study the method of extended quasi-likelihood estimation of the variance function. This method is shown to be closely related to the method of psuedo-likelihood estimation as in Carroll & Ruppert (1982). GRA

N88-15556# North Carolina Univ., Chapel Hill. Dept. of Statistics.
CONDITIONALLY UNBIASED BOUNDED INFLUENCE ROBUST REGRESSION WITH APPLICATIONS TO GENERALIZED LINEAR MODELS Technical Report, Aug. 1986 - Aug. 1987
H. R. Kunsch, L. A. Stefanski, and R. J. Carroll Mar. 1987 18 p
(Contract F49620-85-C-0144)
(AD-A186319; MMS-1717; AFOSR-87-1107TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This document proposes a class of bounded influence robust regression estimators with conditionally unbiased estimating functions given the design. Optimal estimators are found within this class. Applications are made to generalized linear models. An example applying logistic regression to food stamp data is discussed. GRA

N88-15557# Florida Univ., Gainesville. Center for Mathematical System Theory.
MATHEMATICAL TECHNIQUES FOR SYSTEM REALIZATION AND IDENTIFICATION Final Technical Report, 1 Jun. 1985 - 31 Mar. 1987
R. E. Kalman 20 Jul. 1987 6 p
(Grant AF-AFOSR-0186-85)
(AD-A186352; AFOSR-87-1330TR) Avail: NTIS HC A02/MF A01 CSCL 12A

Publications sponsored by this grant were the following: Structures of finite semigroups and generalization; The synthesis theorem for finite regular semigroups and its generalization; A realization theoretic solution of two analytic matrix equations with application to stabilization of infinite dimensional systems, H infinity solutions of Bezout type equations and stabilization of a class of infinite dimensional systems; The problem of prejudice in scientific modeling; and Non-Euclidian metrics and the robust stabilization of systems with parameter uncertainty. GRA

N88-15558# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON THE ASYMPTOTIC JOINT DISTRIBUTIONS OF THE EIGENVALUES OF RANDOM MATRICES WHICH ARISE UNDER COMPONENTS OF COVARIANCE MODEL
Z. D. Bai, P. R. Krishnaiah, and L. C. Zhao Jun. 1987 18 p
(Contract F49620-85-C-0008)
(AD-A186387; TR-87-16; AFOSR-87-1076TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Asymptotic joint distributions are derived of the eigenvalues of some random matrices which arise under components of the covariance model. GRA

N88-15559# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON HYPERCONTRACTIVITY OF ALPHA-STABLE RANDOM VARIABLES, 0 LESS THAN ALPHA LESS THAN 2 Technical Report, Sep. 1986 - Aug. 1987
Jerzy Szulga Jul. 1987 16 p
(Contract F49620-85-C-0144)

(AD-A186425; TR-196; AFOSR-87-1121TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This report on hypercontractivity contains the following: Introduction; properties of hypercontractive random variables; hypercontractivity on the real line; hypercontractivity in normal spaces. GRA

N88-15560# North Carolina Univ., Chapel Hill. Dept. of Statistics.

ON THE CHARACTERIZATION OF CERTAIN POINT PROCESSES Technical Report, Sep. 1986 - Aug. 1987

Tailen Hsing Aug. 1987 23 p

(Contract F49620-85-C-0144)

(AD-A186427; TR-199; AFOSR-87-1064TR) Avail: NTIS HC A03/MF A01 CSCL 12A

It is well known that point process methods can be applied effectively to study certain types of problems in statistical extreme value theory. Consider a strictly stationary sequence of random variables (xi sub j) indexed by the set of integers I=Z. One can define a number of interesting point processes in one dimension by recording the positions where extreme values occur. For example, an extremal process typically is one that records the indices (properly normalized) at which record values of xi sub 1, xi or sub 2 occur, and an exceedance point process considered by Leadbetter consists of the set of points j,n: xi sub j greater than w sub n, where sub n is a suitable sequence of constants. For this type of processes, Poisson or compound Poisson convergence results can often be derived under suitable mixing conditions. GRA

N88-15561# North Carolina Univ., Chapel Hill. Dept. of Statistics.

ON THE EXTREME ORDER STATISTICS FOR A STATIONARY SEQUENCE Technical Report, Sep. 1986 - Aug. 1987

Tailen Hsing Jul. 1987 25 p

(Contract F49620-85-C-0144)

(AD-A186428; TR-198; AFOSR-87-1063TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This document describes a strictly stationary sequence of random variables which satisfies the strong mixing condition (also known as uniform or alpha-mixing). GRA

N88-15562# North Carolina Univ., Chapel Hill. Dept. of Statistics.

THE FILTERING PROBLEM FOR INFINITE DIMENSIONAL STOCHASTIC PROCESSES Technical Report, Oct. 1986 - Sep. 1987

G. Kallianpur and R. L. Karandikar Jan. 1987 12 p

(Contract F49620-85-C-0144)

(AD-A186431; TR-175; AFOSR-87-1131TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The paper presents some recently obtained results on the nonlinear filtering problem for infinite dimensional processes. The optimal filter is obtained as the unique solution of certain measure valued equations. Robustness properties - both pathwise and statistical - are given and a preliminary result shows consistency with the stochastic calculus theory. Applications to random fields and models of voltage potential in neurophysiology are briefly discussed. GRA

N88-15563# North Carolina Univ., Chapel Hill. Dept. of Statistics.

STRONG REPRESENTATION OF WEAK CONVERGENCE Technical Report, Sep. 1986 - Sep. 1987

Z. D. Bai, W. Q. Liang, and W. Vervaat Jun. 1987 8 p

(Contract F49620-85-C-0144)

(AD-A186433; TR-186; AFOSR-87-1354TR) Avail: NTIS HC A02/MF A01 CSCL 12A

This result is proved. If sub n is a separable metric space for n less than or = infinity, phi sub n: S sub n approaches limit of S sub infinity is measurable for less than sub infinity, X sub n is an S sub n valued random variable for n less than or = infinity and phi sub n (X sub n) approaches limit of sub x sub infinity in S sub infinity, then there exists S sub n valued random variables X sub n such that X sub n = d sub x sub n for n less than or = infinity and phi sub n (X sub n) approaches limit of X sub infinity wpl. Conditions on S sub n and phi sub n are presented that allow a construction in the context of Polish spaces. GRA

N88-15564# Michigan Univ., Ann Arbor.

SUBLINEAR UPPER BOUNDS FOR STOCHASTIC PROGRAMS WITH RECOURSE, REVISION

John R. Birge and Roger J. Wets Jun. 1987 30 p Prepared in cooperation with California Univ., Davis

(Contract N00014-86-K-0628)

(AD-A186436; TR-86-26-Rev) Avail: NTIS HC A03/MF A01 CSCL 12A

Separable sublinear functions are used to provide upper bounds on the recourse function of a stochastic program. The resulting problem's objective involves the inf-convultion of convex functions. A dual of this problem is formulated to obtain an implementable procedure to calculate the bound. Function evaluations for the resulting convex program only require a small number of single integrations in contrast with previous upper bounds that require a number of function evaluations that grows exponentially in the number of random variables. The sublinear bound can often be used when other suggested upper bounds are intractible. Computational results indicate that the sublinear approximation provides good, efficient bounds on the stochastic program objective value. GRA

N88-15565# Rome Univ. (Italy). Dipt. di Fisica.

ANOMALOUS SCALING LAWS IN MULTIFRACTAL OBJECTS

Giovanni Paladin and Angelo Vulpiani 10 Jun. 1987 171 p Submitted for publication

(Nota-Interna-883; ETN-88-91244) Avail: NTIS HC A08/MF A01

Anomalous scaling is described in terms of multifractal objects. They are defined by a measure whose scaling properties are characterized by a family of singularities, identified by a scaling exponent. Singularities corresponding to the same exponent are distributed on a fractal set. The multifractal object arises as the superposition of these sets, whose fractal dimensions are related to the anomalous scaling exponents via a Legendre transformation. It is thus possible to reconstruct the probability distribution of the singularity exponents. The application of this formalism to the description of chaotic attractors in dissipative systems, of the energy dissipating set in fully developed turbulence, and of probability distributions in condensed matter problems is reviewed. A simple extension of the method allows treatment from the same point of view temporal intermittency in chaotic systems and sample to sample fluctuations in disordered systems. ESA

N88-15566# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.

AN ELIMINATION TYPE TWO-STAGE PROCEDURE FOR SELECTING THE POPULATION WITH THE LARGEST MEAN FROM k LOGISTIC POPULATIONS

Shanti S. Gupta and ShangHyun Han Aug. 1987 30 p

(Contract N00014-84-C-0167)

(AD-A185614; TR-87-39) Avail: NTIS HC A03/MF A01 CSCL 12A

A formula for an approximation to the distribution of the sample means of a logistic population is derived by using the Edgeworth series expansions. Using this approximation, the authors consider an elimination type two-stage procedure based on the sample means for selecting the population with the largest mean from k logistic populations when the common variance is known. A table of the constants needed to implement this procedure is provided and the efficiency of this procedure relative to the single-stage procedure is investigated. Author (GRA)

N88-15567# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.

ON SELECTING THE BEST OF k LOGNORMAL DISTRIBUTIONS

Shanti S. Gupta and Klaus J. Miescke Aug. 1987 20 p
(Contract N00014-84-C-0167; Grants NSF DMS-86-06964; AF-AFOSR-0347-85)
(AD-A185628; TR-87-36) Avail: NTIS HC A03/MF A01 CSCL 12A

For k lognormal populations, which differ only in one certain parameter, theta, the problem of finding the population with largest value of theta is considered. For two-parameter lognormal families, several natural choices of theta are treated, where the problem can be solved, through logarithmic transformation of the observations, within the framework of estimating parameters in k, possibly restricted, normal populations. For three-parameter lognormal families, this standard approach of selecting in terms of natural estimators fails to work if theta is the guaranteed lifetime. For this case, a selection procedure is derived which is based on an L-statistic which has the smallest asymptotic variance. Of importance here is that it is location equivariant, whereas it does not matter what it actually estimates. Comparisons are made with other suitable selection rules, through the asymptotic relative efficiencies, as well as in an example of intermediate sample sizes. In the latter, it is seen that the selection rule, which is based on the sample minima, compares favorably. GRA

N88-15568# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.
CONTRIBUTIONS TO SELECTION AND RANKING THEORY WITH SPECIAL REFERENCE TO LOGISTIC POPULATIONS
SangHyun Han Aug. 1987 124 p
(Contract N00014-84-C-0167)
(AD-A185629; TR-87-38) Avail: NTIS HC A06/MF A01 CSCL 12A

Selection and ranking (more broadly multiple decision) problems arise in many practical situations where the so-called tests of homogeneity do not provide the answers the experimenter wants. The logistic distribution has been applied in studies of population growth, of mental ability, of bio-assay, of life test data and of biochemical data, but the complete distribution of the sample means and variances of a logistic population has not been obtained yet. This paper studies the selection and ranking problems for logistic populations and an elimination type two-stage procedure for selecting the best population using a restricted subset selection rule in its first stage. GRA

N88-15604*# Alabama Univ., Huntsville. Dept. of Industrial Engineering.
RISK ANALYSIS METHODOLOGY SURVEY
Robert G. Batson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 16 p (For primary document see Summer Faculty Fellowship Program 16 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 12A

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N88-15569# Illinois Univ., Chicago. Statistical Lab.
OPTIMAL REPEATED MEASUREMENTS DESIGNS FOR COMPARING TEST TREATMENTS WITH A CONTROL Interim Report
Dibyen Majumdar Jan. 1987 20 p
(Grant AF-AFOSR-0320-85)
(AD-A185999; TR-87-01; AFOSR-87-1540TR) Avail: NTIS HC A03/MF A01 CSCL 12B

A-optimal and MV-optimal repeated measurements designs are given both for direct and residual treatment effects, for comparing several test treatments with a control. The model considered are basically of two types: without preperiods and the circular model. It is shown that some known balanced and strongly balanced uniform repeated measurements designs can be modified to obtain optimal designs for this problem. Some other methods of finding optimal designs are also given. GRA

N88-15570# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A WEIGHTING SEQUENCE APPROACH TO THE ANALYSIS AND DESIGN OF MULTIVARIABLE CONTROL SYSTEMS Ph.D. Thesis
David J. Cloud 1987 258 p
(AD-A186086; AFIT/CI/NR-87-131D) Avail: NTIS HC A12/MF A01 CSCL 12B

Over the past decade, considerable effort has been devoted to the analysis and design of feedback controllers for systems characterized by uncertain dynamic descriptions, and both frequency-domain and time-domain techniques have been produced by these studies. In this document, additional aspects of the analysis and design problems are investigated. Techniques are derived to enhance the frequency-domain analysis of perturbed systems and to generalize the time-domain concept of self-tuning control to multivariable systems. The first part of this document addresses the problem of generating an accurate description of frequency response uncertainty for systems whose models are generated via system identification. Finite weighting sequence models are found to be particularly useful for this purpose. Techniques are derived to quantify the variability of the frequency response estimates associated with the given model, to identify the optimal truncation level for the specified identification test, and to assess the impact of the bias introduced by truncation. The second part considers the use of multivariable weighting sequences in the development of on-line computer-implemented control algorithms. GRA

N88-15571# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ADMISSIBLE AND SINGULAR TRANSLATES OF STABLE PROCESSES Technical Report, Sep. 1986 - Aug. 1987
Mauro Marques and Stamatis Cambanis Aug. 1987 43 p
(Contract F49620-85-C-0144)
(AD-A186426; TR-201; AFOSR-87-1119TR) Avail: NTIS HC A03/MF A01 CSCL 12B

Translates of symmetric stable and other p sub th order processes are considered. An upper bound for the set of admissible translates of a general p sub th order process is presented, which is a partial analog of the reproducing kernel Hilbert space of a second order process. For invertible stable processes a dichotomy is established, i.e. each translate is either admissible or singular, and the admissible translates are characterized. As a consequence, most continuous time moving averages and all harmonizable processes with nonatomic spectral measure have no admissible translate; and the admissible translates of a general harmonizable process are characterized. The translates of a mixed autoregressive moving averages stable sequence are shown to coincide with those of the Gaussian case. GRA

N88-15572# Atlantis Research Group, Inc., Peabody, Mass.
FEASIBILITY OF SOFTWARE BUILT-IN TEST FOR SDI (STRATEGIC DEFENSE INITIATIVE) APPLICATIONS Final Report, 9 Feb. - 31 Jul. 1987
Richard D. Healey 15 Aug. 1987 49 p
(Contract N00014-87-C-0134)
(AD-A185750; TR-103-1) Avail: NTIS HC A03/MF A01 CSCL 12B

Software Built-In Test (BIT) is a design technique for collecting information from operational software to assist in identifying differences between the real Operating Environment and either the Design or Test Environments. The BIT senses and indicates where the software is operating in new or overload environmental conditions and may, therefore, be more likely to fail. This anomalous situation may be the result of either hardware failure or software design error. The challenge is to incorporate the large number of relatively simple BIT tests into the fault tolerant and continuously operating environment likely to characterize a solution to the battle

management portion of the SDI mission. The challenge is to provide these technical assists in such a way that they can be implemented in operational software with a minimal increase in software development time; it is then reasonable to expect that BIT will not shift from a hard requirement to a nice-to-have feature as schedule pressures potentially impact development. This approach overcomes the problem by providing a standard set of tools for use in the software development environment which will implement BIT with a minimum amount of programmer action. GRA

N88-15635*# Alabama Univ., Huntsville. Dept. of Computer Science.
EXPERT SYSTEM DEVELOPMENT FOR COMMONALITY ANALYSIS IN SPACE PROGRAMS
Dorian P. Yeager *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 28 p (For primary document see Summer Faculty Fellowship Program 28 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 12B

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N88-15573# Florida State Univ., Tallahassee. Dept. of Statistics.
STATIONARY REGENERATIVE SETS AND SUBORDINATORS
P. J. Fitzsimmons and Michael Taksar Nov. 1986 19 p
(Contract F49620-85-C-0007)
(AD-A186298; FSU-TR-M752; AFOSR-87-1043TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper gives a simple construction of the general stationary regenerative set, based on the stationary version of the associated subordinator (increasing Levy process). It is shown that, in a certain sense, the closed range of such a Levy process is a stationary regenerative subset of R. The distribution of this regenerative set is delta-finite in general; it is finite if the increments of the Levy process have finite expectation. GRA

N88-15574# North Carolina Univ., Chapel Hill. Dept. of Statistics.
SERIES REPRESENTATIONS OF INFINITELY DIVISIBLE RANDOM VECTORS AND A GENERALIZED SHOT NOISE IN BANACH SPACES Technical Report, Sep. 1986 - Aug. 1987
Jan Rosinski Jul. 1987 34 p
(Contract F49620-85-C-0144)
(AD-A186429; TR-195; AFOSR-87-1148TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A generalized shot noise in Banach spaces is defined as the a.s. limit of certain centered sums of dependent random vectors; and a necessary and sufficient condition for its existence is given. As an immediate application, the LePage-type series representations of infinitely divisible random vectors are obtained. GRA

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N88-15575# Joint Publications Research Service, Arlington, Va.
USSR REPORT: PHYSICS AND MATHEMATICS
12 Mar. 1987 86 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-87-002) Avail: NTIS HC A05/MF A01

Several topics related to physics and mathematics are discussed. Crystals, laser glasses, semiconductors, lasers, fluid dynamics, nuclear physics, spectroscopy, plasma physics, cosmic rays, and radiation absorption are among the topics covered. For individual titles, see N88-15576 through N88-15597.

N88-15576# Joint Publications Research Service, Arlington, Va.
PHASE PHENOMENA IN PARAMETRIC GENERATORS AND AMPLIFIERS OF ULTRASHORT LIGHT PULSES Abstract Only **c74**
A. Piskarkas, A. Stabinis, and A. Yankauskas *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 13 Transl. into ENGLISH from Uspekhi Fizicheskikh Nauk (Moscow, USSR), v. 150, no. 1, Sep. 1986 p 127-143 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

Progress in the generation and amplification of ultrashort picosecond to femtosecond duration is reviewed. Parametric devices, using quadratically rather than cubically nonlinear media, combine large bandwidth and high gain with wide tunability from ultraviolet to infrared wavelengths. Possible mechanisms of parametric interaction in this kind of device include conversion of quadratic phase modulation of pumping pulses by frequency chirp into phase modulation of emitted pulses, chirp reversal in real time, and self-compression with intense energy transfer. Author

N88-15577# Joint Publications Research Service, Arlington, Va.
DIMENSIONS OF IGNITION ZONES IN BLOW-OUTS OF COMBUSTIBLE GASES FROM RECTANGULAR AND CIRCULAR PORTS Abstract Only **c25**
Yu. A. Kondrashkov, V. P. Tomilin, and G. G. Shevyakov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 14 Transl. into ENGLISH from Fizika Goreniya i Vzryva (Novosibirsk, USSR), v. 22, no. 5, Sep. - Oct. 1986 p 19-22 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

A method for calculating the maximum dimensions of ignition zones in blow-outs of combustible gases for axially-symmetric jets was expanded to include cases of gas jets (effluent from rectangular and circular ports). Formulae for calculating the dimensions were derived theoretically and tested experimentally by analyzing distributions of hydrogen concentration along axis of turbulent and rectangular and circular jets. The concentration was determined using the thermoanemometry method. The length of sections where concentration distribution corresponds to plane-parallel discharge is different for gases with different densities. Therefore, it is more convenient to determine dimensions of ignition zones as the lowest dimensions, calculated according to proposed formulae. This conclusion was supported by concentration distribution in effluent jets. The obtained results make it possible to calculate dimensions of ignition zones in jet blow-outs from rectangular and circular (fan-type) ports for practically any combustible gas. Author

N88-15578# Joint Publications Research Service, Arlington, Va.
TIME CHARACTERISTICS OF TRAVELLING WAVE LASING WITH TWO-PHOTON PICOSECOND OPTICAL PUMPING Abstract Only **c36**
V. I. Prokhorenko and Ye. A. Tikhonov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 19 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1848-1858 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

An experimental study is presented of the dynamics of formation of a generated pulse in a travelling wave laser, indicating that the pulse length decreases monotonically with increasing pumping intensity. The maximum compression achieved was by a factor of approximately 6; the minimum pulse length of 5 ps was achieved at a pumping pulse length of 31 ps. Experimental and calculated values agree approximately up to ten times the pumping threshold for a two-zone energy model of the dye used in the laser with short oscillation relaxation time. At greater excitation, the pulse breaks up into two generated pulses, which can be explained by a four-zone energy model. The compression of the generated pulse is found to be independent of pumping pulse length, the maximum

degree of compression which can be achieved being determined by the pumping intensity and threshold generation. Author

N88-15579# Joint Publications Research Service, Arlington, Va.
INCREASING TIME RESOLUTION OF PICOSECOND ABSORPTION SPECTROMETER BY SELECTION OF LENGTH OF LASER LIGHT PULSES Abstract Only **c36**
B. N. Korvatovskiy, V. V. Gorokhov, S. L. Logunov, and V. Z. Pashchenko *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 20 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1815-1819 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

Picosecond adsorption spectroscopy requires measurement of changes in the absorption of light in the specimen studied, induced by an exciting light pulse. With very rapid relaxation, the signal recorded depends not only on the amplitude, but also on the time profile of the pulses, so that fluctuations in pulse length contribute to measurement error. A method is suggested for monitoring the relative change in picosecond pulse length and selecting pulses within a predetermined length range based on generation of a second harmonic. Length selection of pulses in a spectrometer increases the accuracy of recording spectrometric curves and improves the time resolution of the method. The statistical parameters of picosecond spectrometer light pulses were measured, demonstrating the possibility of decreasing measurement error by selection of pulses by length. Author

N88-15580# Joint Publications Research Service, Arlington, Va.
DYNAMIC RESTRUCTURING OF PULSED CO2 LASER FREQUENCY AND MULTIPLE-PEAK GENERATION IN A CELL WITH IR-ABSORBING GAS IN THE RESONATOR Abstract Only **c36**
G. N. Makarov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 20-21 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1801-1807 Original language document was announced in IAA as A87-28463 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

The first experimental results are presented on the dynamic frequency tuning of pulsed carbon dioxide lasers through the use of a cell containing an infrared radiation adsorbing gas. Using this method, sequences of 3 to 6 pulses 100 ns in duration are obtained during a single laser burst. Simultaneous lasing was obtained at 3 to 5 lines as well as a train of 8 to 10 pulses of the same frequency, 100 ns in duration, with 150 to 300 ns intervals between them. Author

N88-15581# Joint Publications Research Service, Arlington, Va.
CAUSES AND DISTRIBUTION OF FAILURES IN SEMICONDUCTOR LASERS (A REVIEW) Abstract Only **c36**
P. G. Yeliseyev *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 21 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1749-1769 Original language document was announced in IAA as A87-28460 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

Different factors that affect the reliability of semiconductor lasers are discussed, and laboratory results pertaining to their service life are reviewed. It is found that the operational lifetime of GaAlAs/GaAs injection lasers exceeds 50,000 h; extrapolation from high temperature tests reveals that it may even exceed 1 million h. InGaAsP/InP lasers are characterized by even longer operational lifetimes, and published data show that the extrapolated value of the continuous operational lifetime is greater than 10 billion h at 10 C. The shape and parameters of the failure distribution are discussed as well as lifetime prediction methods. Author

N88-15582# Joint Publications Research Service, Arlington, Va.
STUDY OF VIBRATION RELAXATION IN ACTIVE MEDIUM OF CO2-LASER USING PHASE-ABSORPTION METHOD Abstract Only **c36**
B. F. Kuntsevich, A. N. Pisarchik, and V. V. Churakov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 22 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroscopii (Minsk, USSR), v. 44, no. 3, Mar. 1986 p 381-388 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

A modification of a phase-absorption method was tested as it applied to studies of the rate of decay of energy stored in the active medium of carbon dioxide lasers. Current density of discharge exciting a gas mixture is modulated with a certain frequency. Populations of carbon dioxide vibration levels change with the same frequency. The change of populations is controlled using weak probing radiation. Analysis of experimental results of measuring phase shift as a function of discharge current modulation frequency for three different mixtures demonstrated that they agreed qualitatively with the theoretical expression, with the exception of the low frequency area (not exceeding 200 Hz). Author

N88-15583# Joint Publications Research Service, Arlington, Va.
TEA-TE: POWERFUL NITROGEN-BASED LASER SYSTEM Abstract Only **c36**
Yu. V. Zvinevich, I. N. Kazimirchik, N. A. Nemkovich, A. N. Rubinov, and V. I. Tomin *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 23 Transl. into ENGLISH from Zhurnal Prikladnoy Spectroscopii (Minsk, USSR), v. 44, no. 3, Mar. 1986 p 509-511 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

An efficient TEA-TE nitrogen based system with short generation pulse, designed mainly for kinetic spectroscopy studies, was developed. A reliable permanent synchronization of the generator and the amplifier was achieved. Dependence of output radiation energy of the entire laser system on the energy of generator radiation injected into the amplifier was studied, and the amplification factor was calculated. A specific feature of the amplifier-generator system is a high stability of output radiation caused by nonlinearity of the system amplifier. Author

N88-15584# Joint Publications Research Service, Arlington, Va.
INTRACAVITY SPECTRUM ANALYZER WITH NaF:F2(+):F3(-) CRYSTAL LASER FOR LONG-WAVE IR WAVE BAND Abstract Only **c36**
V. A. Vratskiy and A. N. Kolerov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 24 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroskopii (Minsk, USSR), v. 44, no. 4, Apr. 1986 p 576-580 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

An intracavity spectrum analyzer with NaF:F sub 2 (+):F sub 3 (-) crystal laser was used to widen the long-wave application boundary of intracavity laser spectroscopy into the IR waveband and to increase sensitivity. The spectrum analyzer was used for gas and plasma diagnostics. Spectra of atmospheric air and water steam were studied. A number of new lines were detected in the absorption spectra of atmospheric air and in a carbon arc plasma flame, which meant that the real sensitivity of the analyzer was at a (1 to 3) times 10 to the minus 8th power cm (-) level. Concentration of molecules and the absorption cross section of low pressure water steam in a dish was assessed experimentally. The absorption spectra of complex fluorohydrocarbons were studied. It was demonstrated that the spectrum analyzer makes it possible to analyze substances both in gaseous and ionized states. Author

N88-15585# Joint Publications Research Service, Arlington, Va.
STUDY OF KINETICS OF INTRACAVITY ABSORPTION IN PULSED DYE LASERS Abstract Only **c36**
V. S. Burakov, V. A. Malashonok, S. V. Nechayev, R. A. Pupko, S. N. Raykov, and S. I. Shedenkov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 25 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroskopii (Minsk, USSR), v. 44, no. 4, Apr. 1986 p 567-572 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

The kinetics of intracavity absorption in dye lasers with tube pumping and with ruby laser second harmonic pumping was studied. Time dependence of laser generation intensity for various values of the optical density of selective losses was studied. It was concluded that competition of laser modes determined to a large degree the kinetics of intracavity absorption in multimode pulsed action dye lasers with generation length not exceeding several microseconds. Study results demonstrated the complex character of the process of intracavity absorption in pulsed dye lasers with generation length equal to 10 (-8) -10 (-6) s. The use of a recording system with time resolution of a laser generation pulse makes it possible to increase the sensitivity of intracavity measurements.
Author

N88-15586# Joint Publications Research Service, Arlington, Va.
EFFECT OF MULTIPLICATION OF SPECTRAL COMPONENTS OF MULTI-FREQUENCY LASING OF PULSED TUNABLE LASER Abstract Only **c36**
V. I. Kravchenko and V. V. Taranov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 26 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 22, 26 Nov. 1986 p 1381-1385 Original language document was announced in IAA as A87-26407 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

An experiment is reported in which multifrequency emission was obtained as a result of the simultaneous diffraction of several light beams incident at different angles on a common diffraction grating representing a dispersion element of a laser resonator. The characteristics of the multifrequency emission are discussed. It is shown that the number of spectral components multiplies with the number of diffracted beams and that individual control of the spectral components is difficult. The effect of the spectral component multiplication is of interest from the standpoint of the development of tunable lasers and modeling of complex laser spectra for multifrequency optical communications and correlation analysis.
Author

N88-15587# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF LKI-501 TUNABLE DYE LASER WITH DYES IN SOLID MATRIX Abstract Only **c36**
A. I. Zhiltsov, A. G. Klimashina, V. Ye. Mnuskin, V. G. Nikiforov, A. N. Tokareva, and B. F. Trinchuk *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 27 Transl. into ENGLISH from Zhurnal Prikladnoy Spektroskopii (Minsk, USSR), v. 45, no. 1, Jul. 1986 p 35-39 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

An experimental study of the LKI-501 tunable dye laser was made with dyes in a solid matrix of polymethyl methacrylate and with pumping by second harmonic radiation from a YAG:Nd (3+) laser in pulses of 11 ns duration at a repetition rate of 25 Hz. The characteristics of second harmonic radiation emission by the LKI-501 with active media were measured.
Author

N88-15588# Joint Publications Research Service, Arlington, Va.
DYE LASER FOR HOLOGRAPHIC INTERFEROMETRY Abstract Only **c36**
I. S. Zeylikovich, A. M. Lyalikov, and N. M. Spornik *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 27-28 Transl. into ENGLISH from Kvantonaya Elektronika (Moscow, USSR), v. 13, no. 7, Jul. 1986 p 1386-1390 Original language document was announced in IAA as A87-24309 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

A study was made of the spatial-temporal coherence of a pulsed dye laser with a cavity containing a grazing-angle diffraction grating. Two-frequency operation is demonstrated with continuous tuning of the spectral interval between the laser emission lines. The possibilities afforded by such a laser in holographic interferometry and in the holographic formation of the contours of a relief are discussed.
Author

N88-15589# Joint Publications Research Service, Arlington, Va.
GENERATION OF LIGHT PULSES IN SEMICONDUCTOR LASER UPON EXCITATION BY SEVERAL ELECTRON BEAMS Abstract Only **c36**
K. V. Aleksandrovich, V. V. Druzhinin, V. A. Kovalenko, and M. D. Tarasov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 28-29 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 7, Jul. 1986 p 1336-1341 Original language document was announced in IAA as A87-24304 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

A study is made of semiconductor lasers based on GaAs and CdS excited by several closely spaced simultaneous beams of fast electrons. A change in the direction of light emission is detected, which results in a considerable shortening of the light pulses in comparison with the duration of pumping. It is shown that this effect is due to the presence of two different lasing thresholds for mutually perpendicular types of electromagnetic waves.
Author

N88-15590# Joint Publications Research Service, Arlington, Va.
PROPAGATION OF RADIATION ALONG A CONSTRICTING OPTICAL WAVEGUIDE Abstract Only **c74**
V. M. Andreyev, K. F. Yeskin, and Ye. Ye. Glukhova *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 41 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 2, Aug. 1986 p 432-434 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

The parabolic equation approximation was used to analyze the propagation of radiation along a constricting planar waveguide. The major advantage of the parabolic equation is a decrease in order with respect to z. The method outlined was used two calculate the distribution of the field of the electromagnetic wave in various cross sections of a constricting planar waveguide with the parameters of air, vinyl trimethylsilane and plexiglass. The parabolic equation approximation is found to describe the process of radiation from a constricting planar optical waveguide with sufficient accuracy, allowing determination of the distribution of the field in any cross section of the waveguide.
Author

N88-15591# Joint Publications Research Service, Arlington, Va.
CROSS SECTION OF RESONANT RAMAN SCATTERING OF LIGHT BY POLYENES Abstract Only **c74**
V. V. Verdyugin, K. Ya. Burshteyn, and P. P. Shorygin *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 41-42 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 2, Aug. 1986 p 299-302 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

An experimental study is presented of the resonant Raman spectra of beta carotene. Absolute differential cross sections are obtained for the most intensive Raman spectral lines with excitation at the absorption maximum. A theoretical analysis is presented of the variation in absolute differential cross section as a function of a number of conjunct double bonds in the polyenes.
Author

N88-15592# Joint Publications Research Service, Arlington, Va.
SOLITON MODE OF PROPAGATION OF LIGHT PULSES THROUGH SINGLE-MODE OPTICAL FIBERS AND PROBLEMS OF ITS EXPERIMENTAL REALIZATION Abstract Only **c74**
V. Yu. Petrunkin, A. V. Selishev, V. M. Sysuyev, and A. S. Shcherbakov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 51-52 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 16, 26 Aug. 1986 p 988-991 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

Transmission of data over fiber optic communication lines in the form of solitons appears to be a promising way to increase the speed of transmission. Such a mode of data transmission requires proper matching of light source and light guide parameters to ensure self-compression of anomalously scattering wave packets

and formation of steady one dimensional solitons. Theoretically, propagation of a soliton through a real optical fiber can be described a cubic Schroedinger equation. This equation can be solved as an inverse problem of scattering with the aid of perturbation theory, which insures exact integration of the corresponding system of Marchenko equations. The solution indicates the requirements for formation and propagation of solitons. An optical data transmission system built experimentally on this basis for design and performance analysis includes a source of ultrashort light pulses, namely a parametric light generator without resonator, a more than 20 percent efficient coupling, a single mode quartz fiber 600 m long with a core diameter of 7 microns and a loss factor not exceeding 1.5 dB/km, and a device for recording solitons within the 1.06 to 1.60 micron range of crystal wavelengths. Author

N88-15593# Joint Publications Research Service, Arlington, Va.
MULTILAYER HOLOGRAPHIC FUNCTIONAL ELEMENT IN ANALOG-DIGITAL CONVERTER Abstract Only **c35**
N. N. Yevtikhiyev, D. I. Mirovitskiy, N. V. Rostovtseva, and O. B. Serov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 61 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 9, Sep. 1986 p 1794-1800 Original language document was announced in IAA as A87-28462 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

A qualitatively novel type of functional element which is based on a multilayer thin phase hologram is proposed for use in an optoelectronic analog-digital converter system. The feasibility of controlling the ratio of the intensities of the beams of different orders by changing the angle of incidence of the reconstructing wave is demonstrated. A calculation of the functional elements is performed on two- and four-layer holograms. An experimental apparatus was designed for converting an electric analog signal into a five-bit binary word using an electrooptic deflector and a two-layer hologram. Author

N88-15594# Joint Publications Research Service, Arlington, Va.
ASSESSMENT OF ANOMALOUS GRAVITATIONAL FIELD OF ELASTIC EARTH Abstract Only **c46**
Zh. S. Yerzhanov, A. A. Kalybayev, and A. N. Isayev *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 63 Transl. into ENGLISH from Izvestiya Akademii Nauk Kazakhskoy SSR: Seriya Fizikomaternaticheskaya (Alma-Ata, USSR), Sep. - Oct. 1986 p 65-69 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

The problem of determining the stress deformed state and density of Earth, simulated by a rotating elastic self-gravitating sphere, was examined. Using the mass conservation law, Lame equations were solved so that the equilibrium figure and force function of the external gravitational field of the model were close to the figure and external Newton potential of the real Earth. As the Earth model, a stratified sphere with centrally symmetric mass distribution was examined. The sphere was represented by an absolutely solid core and a mantle, enclosed by an elastic isotropic lithosphere. Mass distribution in the mantle and lithosphere was derived, based on the characteristic equation of bowels of stars. The selection of the Earth model was based on the preservation of interfaces, values of density jumps at the interfaces, and the prehistory of the gas-dust origin of Earth, as well as on the principal elements of the figure of the Earth, its external gravitational field, and electric potential. Author

N88-15595# Joint Publications Research Service, Arlington, Va.
PRESSURE AND MASS VELOCITY MEASUREMENTS IN SOLIDS SUBJECTED TO DYNAMIC LOADINGS Abstract Only
P. A. Urtiew, R. M. Erikson, B. Hayes, and M. L. Parker *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 64-65 Transl. into ENGLISH from Fizika Goreniya i Vzryva (Novosibirsk, USSR), v. 22, no. 5, Sep. - Oct. 1986 p 113-126 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

The work was prompted by the need to measure pressure and mass velocity in reacting media. Manganine pressure and mass velocity were used for conducting experiments in the reacting medium, as well as for detailed studies of Taylor waves in powerful detonating explosives. Experimental results demonstrated monotonic dependence between pressure and the charge. The four described diagnostic procedures can be used together in the same experiment and even in the same plane, which is important in cross-testing experimental results. The only exception is the combination of manganine pressure and mass velocity transducers that cannot be used in close proximity to each other because of the interference of two magnetic fields. Author

N88-15596# Joint Publications Research Service, Arlington, Va.
MULTIPLY CHARGED PARTICLES IN PRIMARY COSMIC RAYS WITH ENERGY LESS THAN OR EQUAL TO 2 TeV Abstract Only **c93**
I. P. Ivanenko, N. L. Grigorov, V. Ya. Shestoperov, Yu. V. Basina, P. V. Vakulov, Yu. Ya. Vasilyev, R. M. Golynskaya, L. B. Grigoryeva, D. A. Zhuravlev, and V. I. Zatsepin et al. *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 66-67 Transl. into ENGLISH from Pisma v Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki (Moscow, USSR), v. 44, no. 4, 25 Aug. 1986 p 200-202 Previously announced in IAA as A87-29683 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

Data on the energy spectra and charge composition of primary cosmic ray particles with energies greater than 2 TeV are analyzed. The equipment on the Cosmos 1543 satellite used to obtain the data is described. Protons and alpha particles are detected , and the nuclei are separated into H, M, VH, and alpha groups. It is determined that the charge compositions of the primary nuclei with z greater than about 2 and energies greater than about 2 TeV compare well with the data obtained at energies greater than about 1 to 10 GeV/nucleon. Author

N88-15597# Joint Publications Research Service, Arlington, Va.
EXPLOSIVE ABSORPTION OF LASER BEAM OF FINITE DIAMETER Abstract Only **c36**
A. N. Orayevskiy and I. Ye. Protsenko *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 67 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 7, Jul. 1986 p 1467-1472 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

Explosive absorption of an infrared laser beam such as a carbon dioxide laser beam by molecules during transitions between excited states is analyzed, assuming a quasi-equilibrium distribution of molecules over levels of the absorbing mode approximately identical to the Boltzmann distribution for a harmonic oscillator with the VT-relaxation time for the n-th level tau (n) over VT equals n tau (1) over VT. First, the effect of heat transfer within the laser beam of finite diameter on the dynamics of explosive absorption is evaluated on the basis of the system of two equations of kinetics for vibrational energy and the transitional temperature of molecules. The stability limit of its steady state solution for boundary conditions is determined in accordance with the theory of thermal explosion. Next, the characteristics of explosive absorption related to the finiteness of the VV exchange are determined. It was determined that the threshold of explosive absorption depends on both the laser beam diameter and the laser pulse duration. Author

N88-15598# Naval Research Lab., Washington, D.C.
TeXting THE FORMULARY: A COLLECTION OF EXAMPLES OF THE USE OF TeX TO PRODUCE RULED TABLES AND DISPLAYED EQUATIONS
David L. Book, Todd Brun, and Robert J. Scotgt 6 Oct. 1987 138 p
(AD-A185920; AD-F000114; NRL-MR-6044) Avail: NTIS HC A07/MF A01 CSCL 20I

The NRL Plasma Formulary is a collection of formulas and reference data in a handy pocketsized booklet. This report contains

some sixty pages of text, tables, and displayed equations, together with the associated TEX files. An enlarged copy (the output from an IMAGEN ink-jet printer) of each page of the Formulary, identical with that which was photographically reduced for the actual book, is reprinted facing the TEX source code that generated it. Users can browse through the report until they come to a table or displayed equation similar to the one they want to produce, then extract from the facing page the control sequences they need. GRA

N88-15599# State Univ. of New York, Buffalo. Dept. of Chemistry.
COHERENT STATES FOR THE DAMPED HARMONIC OSCILLATOR
K. H. Yeon, C. I. Um, and Thomas F. George Sep. 1987 22 p (Contract N00014-86-C-0043)
(AD-A186111; UBUFFALO/DC/87/TR-52) Avail: NTIS HC A03/MF A01 CSCL 12B

Using the Caldirola-Kanai Hamiltonian for the damped harmonic oscillator, exact coherent states are constructed. These new coherent states satisfy the properties which coherent states should generally have. GRA

N88-15600# Materials Research Labs., Ascot Vale (Australia).
PROPERTIES OF A MAGNETIC DIPOLE
P. J. Ryan Jun. 1987 15 p
(AD-A186128; MRL-TN-521; AR-005-156) Avail: NTIS HC A03/MF A01 CSCL 20C

Magnetic phenomena differ from electric phenomena since there are no free magnetic charges or poles. The basic entity in magnetic phenomena is thus the magnetic dipole - the magnetic analog of the electric dipole consisting of two opposite charges placed very close together. Bulk magnetic phenomena such as magnetization are generally described in terms of accumulations of magnetic dipoles. However standard works on electromagnetism usually describe only the simple features of the dipole without verifying all its properties. This note explores the physical and mathematical properties of the classical magnetic dipole. These properties enable the dipole to be considered as one of the fundamental magnetostatic units. GRA

N88-15601*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH REPORTS: 1987 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM
Gerald R. Karr, ed., Ernestine K. Cothran, ed., and L. Michael Freeman, ed. (Alabama Univ., Tuscaloosa.) Nov. 1987 810 p Program held in Huntsville, Ala., 1 Jun. - 7 Aug. 1987
(Grant NGT-01-008-021)
(NASA-CR-179219; NAS 1.26:179219) Avail: NTIS HC A99/MF E03 CSCL 20C

For the 23rd consecutive year, a NASA/ASEE Summer Faculty Fellowship Program was conducted at the Marshall Space Flight Center (MSFC). The program was conducted by the University of Alabama in Huntsville and MSFC during the period 1 June to 7 August 1987. Operated under the auspices of the American Society for Engineering Education, the MSFC program, as well as those at other NASA Centers, was sponsored by the Office of University Affairs, NASA Headquarters, Washington, D.C. The basic objectives of the program are: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of the participant's institutions; and (4) to contribute to the research objectives of the NASA Centers. This document is a compilation of Fellow's reports on their research during the Summer of 1987. For individual titles, see N88-15602 through N88

N88-15602*# Missouri Univ., Rolla. Dept. of Physics.
PROBLEMS AND POSSIBLE SOLUTIONS INVOLVED IN HARD TARGET CALIBRATION OF COHERENT DOPPLER LIDAR **c36**
Richard Anderson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 27 p (For primary document see Summer Faculty Fellowship Program 27 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20E

The field of radiometry is surveyed with reference to coherent light, since the surfaces to be considered here are irradiated with coherent, polarized light. Definitions of some concepts are modified. In light of these modifications calibration problems are analyzed and solutions suggested. The most important task was to develop hard targets exhibiting minimal specular reflection (mirror-like and retroreflection) and following closely a Lambertian scattering curve. Bistable reflectometer experiments and integrating sphere measurements are used to physically characterize the targets. Optical and electron microscopy are used to physically characterize the targets. Since the BRDF matrix is not measured, this capability must be developed preferably for both bistatic and monostatic reflectometer measurements. The equipment is expensive and not yet developed. Calibration can be simplified if it can be proved that the BRDF matrix is diagonal for a diffuse scatterer. Author

N88-15603*# Rice Univ., Houston, Tex. Dept. of Physics.
SOME CONSIDERATIONS ON MEASURING THE NEWTONIAN GRAVITATIONAL CONSTANT G IN AN ORBITING LABORATORY **c46**
Stephen D. Baker *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 7 p (For primary document see Summer Faculty Fellowship Program 7 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 08G

No fundamental reason has been identified for rejecting the notion of measuring the Newtonian gravitational constant G by observing an artificial binary in a near-Earth orbiting laboratory. Author

N88-15604*# Alabama Univ., Huntsville. Dept. of Industrial Engineering.
RISK ANALYSIS METHODOLOGY SURVEY **c65**
Robert G. Batson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 16 p (For primary document see Summer Faculty Fellowship Program 16 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 12A

NASA regulations require that formal risk analysis be performed on a program at each of several milestones as it moves toward full-scale development. Program risk analysis is discussed as a systems analysis approach, an iterative process (identification, assessment, management), and a collection of techniques. These techniques, which range from simple to complex network-based simulation were surveyed. A Program Risk Analysis Handbook was prepared in order to provide both analyst and manager with a guide for selection of the most appropriate technique. Author

N88-15605*# Alabama A & M Univ., Huntsville. Dept. of Mathematics.
COMPILATION AND DEVELOPMENT OF K-6 AEROSPACE MATERIALS FOR IMPLEMENTATION IN NASA SPACELINK ELECTRONIC INFORMATION SYSTEM **c82**
Jean A. Blake *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program 15 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 05B

Spacelink is an electronic information service to be operated by the Marshall Space Flight Center. It will provide NASA news and educational resources including software programs that can be accessed by anyone with a computer and modem. Spacelink is currently being installed and will soon begin service. It will provide daily updates of NASA programs, information about NASA educational services, manned space flight, unmanned space flight, aeronautics, NASA itself, lesson plans and activities, and space program spinoffs. Lesson plans and activities were extracted from

existing NASA publications on aerospace activities for the elementary school. These materials were arranged into 206 documents which have been entered into the Spacelink program for use in grades K-6. Author

N88-15606*# Alabama Univ., Huntsville. Dept. of Computer Science.
INVESTIGATION OF CANDIDATE DATA STRUCTURES AND SEARCH ALGORITHMS TO SUPPORT A KNOWLEDGE BASED FAULT DIAGNOSIS SYSTEM c61
Edward L. Bosworth, Jr. *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program 15 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

The focus of this research is the investigation of data structures and associated search algorithms for automated fault diagnosis of complex systems such as the Hubble Space Telescope. Such data structures and algorithms will form the basis of a more sophisticated Knowledge Based Fault Diagnosis System. As a part of the research, several prototypes were written in VAXLISP and implemented on one of the VAX-11/780's at the Marshall Space Flight Center. This report describes and gives the rationale for both the data structures and algorithms selected. A brief discussion of a user interface is also included. Author

N88-15607*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
INVESTIGATION OF LOW VELOCITY IMPACT DAMAGE ON FILAMENTARY COMPOSITE MATERIALS c24
Mark V. Bower *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 24 p (For primary document see Summer Faculty Fellowship Program 24 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11D

Presented are the results of an investigation of the effect of low velocity impact on the residual modulus and residual strength of flat filamentary composite materials. Theoretical analysis of composite materials indicates that the modulus of the material must decrease as impact damage increases. This decrease must also correlate to the decrease in residual strength. This study attempts to verify these hypotheses. Graphite/epoxy laminates (AS4/3501-6) of various fiber orientations (8 (0 deg), 2 (+ or - 45 deg)sub 8) were impacted using a falling weight impact tester. Impact energies ranged from 0.42 to 1.55 ft-lb, with impact velocities from 2.03 to 3.98 ft/sec. The results show that there is a reduction in residual modulus of the plate as the impact energy increases. Author

N88-15608*# Morehouse Coll., Atlanta, Ga. Dept. of Mathematics.
INVESTIGATION OF THE FEASIBILITY OF AN ANALYTICAL METHOD OF ACCOUNTING FOR THE EFFECTS OF ATMOSPHERIC DRAG ON SATELLITE MOTION c18
Robert E. Bozeman *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 27 p (For primary document see Summer Faculty Fellowship Program 27 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 22B

An analytic technique for accounting for the joint effects of Earth oblateness and atmospheric drag on close-Earth satellites is investigated. The technique is analytic in the sense that explicit solutions to the Lagrange planetary equations are given; consequently, no numerical integrations are required in the solution process. The atmospheric density in the technique described is represented by a rotating spherical exponential model with superposed effects of the oblate atmosphere and the diurnal variations. A computer program implementing the process is discussed and sample output is compared with output from program NSEP (Numerical Satellite Ephemeris Program). NSEP uses a numerical integration technique to account for atmospheric drag effects. Author

N88-15609*# DePauw Univ., Greencastle, Ind. Dept. of Physics and Astronomy.
RESOLUTION OF HOLOGRAMS PRODUCED BY THE FLUID EXPERIMENT SYSTEM AND THE HOLOGRAPHY GROUND SYSTEM c35
Howard L. Brooks *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 21 p (For primary document see Summer Faculty Fellowship Program 21 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 14E

The Fluid Experiment System (FES) was developed to study low temperature crystal growth of triglycine sulfate from solution in a low gravity environment onboard Spacelab. The first flight of FES was in 1985. FES uses an optical system to take holograms of the growing crystal to be analyzed after the mission in the Holography Ground System (HGS) located in the Test Laboratory at Marshall Space Flight Center. Microscopic observation of the images formed by the reconstructed holograms is critical to determining crystal growth rate and particle velocity. FES and HGS were designed for a resolution of better than 20 micrometers, but initial observation of the flight holograms show a limit of 80 micrometers. The resolution of the FES holograms is investigated, as well as the role of beam intensity ratio and exposure time on the resolution of HGS produced holograms. Author

N88-15610*# Tennessee Univ., Chattanooga. Center of Applications - Computer Applications.
ENHANCEMENT OF COMPUTER SYSTEM FOR APPLICATIONS SOFTWARE BRANCH c61
Alex Bykat *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 43 p (For primary document see Summer Faculty Fellowship Program 43 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

Presented is a compilation of the history of a two-month project concerned with a survey, evaluation, and specification of a new computer system for the Applications Software Branch of the Software and Data Management Division of Information and Electronic Systems Laboratory of Marshall Space Flight Center, NASA. Information gathering consisted of discussions and surveys of branch activities, evaluation of computer manufacturer literature, and presentations by vendors. Information gathering was followed by evaluation of their systems. The criteria of the latter were: the (tentative) architecture selected for the new system, type of network architecture supported, software tools, and to some extent the price. The information received from the vendors, as well as additional research, lead to detailed design of a suitable system. This design included considerations of hardware and software environments as well as personnel issues such as training. Design of the system culminated in a recommendation for a new computing system for the Branch. Author

N88-15611*# Alabama Univ., Huntsville. Dept. of Physics and Astronomy.
INFRARED EMISSION AND TIDAL INTERACTIONS OF SPIRAL GALAXIES c90
Gene G. Byrd *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program 19 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 03B

Computer simulations of tidal interactions of spiral galaxies are used to attempt to understand recent discoveries about infrared (IR) emitting galaxies. It is found that the stronger tidal perturbation by a companion the more disk gas clouds are thrown into nucleus crossing orbits and the greater the velocity jumps crossing spiral arms. Both these tidally created characteristics would create more IR emission by high speed cloud collisions and more IR via effects of recently formed stars. This expectation at greater tidal

perturbation matches the observation of greater IR emission for spiral galaxies with closer and/or more massive companions. The greater collision velocities found at stronger perturbations on the models will also result in higher dust temperature in the colliding clouds. In the IR pairs examined, most have only one member, the larger, detected and when both are detected, the larger is always the more luminous. In simulations and in a simple analytic description of the strong distance dependence of the tidal force, it is found that the big galaxy of a pair is more strongly affected than the small. Author

N88-15612*# Tennessee Univ., Martin. School of Engineering Technology and Engineering.
EVALUATION OF HIGH-VOLTAGE, HIGH-POWER, SOLID-STATE REMOTE POWER CONTROLLERS FOR AMPS c33
Charles P. Callis *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 24 p (For primary document see Summer Faculty Fellowship Program 24 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09A

The Electrical Power Branch at Marshall Space Flight Center has a Power System Development Facility where various power circuit breadboards are tested and evaluated. This project relates to the evaluation of a particular remote power controller (RPC) energizing high power loads. The Facility equipment permits the thorough testing and evaluation of high-voltage, high-power solid-state remote power controllers. The purpose is to evaluate a Type E, 30 Ampere, 200 V dc remote power controller. Three phases of the RPC evaluation are presented. The RPC is evaluated within a low-voltage, low-power circuit to check its operational capability. The RPC is then evaluated while performing switch/circuit breaker functions within a 200 V dc, 30 Ampere power circuit. The final effort of the project relates to the recommended procedures for installing these RPC's into the existing Autonomously Managed Power System (AMPS) breadboard/test facility at MSFC. Author

N88-15613*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Mechanical Engineering.
VERIFICATION OF FANTASTIC INTEGRATED CODE c39
Rajinder Singh Chauhan *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 13 p (For primary document see Summer Faculty Fellowship Program 13 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20K

FANTASTIC is an acronym for Failure Analysis Nonlinear Thermal and Structural Integrated Code. This program was developed by Failure Analysis Associates, Palo Alto, Calif., for MSFC to improve the accuracy of solid rocket motor nozzle analysis. FANTASTIC has three modules: FACT - thermochemical analysis; FAHT - heat transfer analysis; and FAST - structural analysis. All modules have keywords for data input. Work is in progress for the verification of the FAHT module, which is done by using data for various problems with known solutions as inputs to the FAHT module. The information obtained is used to identify problem areas of the code and passed on to the developer for debugging purposes. Failure Analysis Associates have revised the first version of the FANTASTIC code and a new improved version has been released to the Thermal Systems Branch. Author

N88-15614*# Alabama Univ., Huntsville. Dept. of Applied Optics.
PATTERN RECOGNITION TECHNIQUES FOR FAILURE TREND DETECTION IN SSME GROUND TESTS c35
A. Choudry *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 29 p (For primary document see Summer Faculty Fellowship Program 29 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 14E

The Space Shuttle Main Engine (SSME) is a complex power plant. To evaluate its performance 1200 hot-wire ground tests have been conducted, varying in duration from 0 to 500 secs. During the test some 500 sensors are sampled every 20 ms. The sensors are generally bounded by red lines so that an excursion beyond could lead to premature shutdown. In 27 tests it was not possible to effect an orderly premature shutdown, resulting in major incidents with serious damage to the SSME and test stand. The application of pattern recognition are investigated to detect SSME performance trends that may lead to major incidents. Based on the sensor data a set of (n) features is defined. At any time during the test, the state of the SSME is given by a point in the n-dimensional feature space. The history of a test can now be represented as a trajectory in the n-dimensional feature space. Portions of the normal trajectories and failed test trajectories would lie in different regions of the n-dimensional feature space. The latter can now be partitioned into regions of normal and failed tests. Thus, it is possible to examine the trajectory of a test in progress and predict if it is going into the normal or failure region. Author

N88-15615*# Alabama Univ., Huntsville. Dept. of MIS/MSC.
MICROPROCESSOR CONTROL AND NETWORKING FOR THE AMPS BREADBOARD c60
Stephen A. Floyd *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program 20 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

Future space missions will require more sophisticated power systems, implying higher costs and more extensive crew and ground support involvement. To decrease this human involvement, as well as to protect and most efficiently utilize this important resource, NASA has undertaken major efforts to promote progress in the design and development of autonomously managed power systems. Two areas being actively pursued are autonomous power system (APS) breadboards and knowledge-based expert system (KBES) applications. The former are viewed as a requirement for the timely development of the latter. Not only will they serve as final testbeds for the various KBES applications, but will play a major role in the knowledge engineering phase of their development. The current power system breadboard designs are of a distributed microprocessor nature. The distributed nature, plus the need to connect various external computer capabilities (i.e., conventional host computers and symbolic processors), places major emphasis on effective networking. The communications and networking technologies for the first power system breadboard/test facility are described. Author

N88-15616*# LeTourneau Coll., Longview, Tex. Dept. of Natural Science.
EQUILIBRIUM RETENTION IN THE NOZZLE OF OXYGEN HYDROGEN PROPULSION SYSTEMS c20
D. I. Ford *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 26 p (For primary document see Summer Faculty Fellowship Program 26 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 21H

Arguments are presented for the retention of vibrational equilibrium of species in the nozzle of the Space Shuttle Main Engine which are especially applicable to water and the hydroxyl radical. It is shown that the reaction OH + HH yields HOH + H maintains equilibrium as well. This is used to relate OH to H, the temperature, and the oxidizer-to-fuel ratio. Author

N88-15617*# Auburn Univ., Ala. Dept. of Physics.
ATOMIC OXYGEN EFFECTS ON METALS c26
Albert T. Fromhold *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 28 p (For primary document see Summer Faculty Fellowship Program 28 p (SEE N88-15601

07-70)
Avail: NTIS HC A99/MF E03 CSCL 11F

The effect of specimen geometry on the attack of metals by atomic oxygen is addressed. This is done by extending the coupled-currents approach in metal oxidation to spherical and cylindrical geometries. Kinetic laws are derived for the rates of oxidation of samples having these geometries. It is found that the burn-up time for spherical particles of a given diameter can be as much as a factor of 3 shorter than the time required to completely oxidize a planar sample of the same thickness. Author

N88-15618*# Oakwood Coll., Huntsville, Ala. Dept. of Business and Information Systems Management.
THE FEASIBILITY OF USING TAE AS THE UIL FOR THE SPACE STATION AND FOR OTHER INTERNAL NASA TASKS AND PROJECTS c61
Esther Naomi Gill *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program 22 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

This description of the Transportable Applications Executive (TAE) is intended to serve to test the feasibility of its use as the Space Station User Interface Language (SSUIL). TAE was developed by the Space Data and Computing Division, Space and Earth Sciences Directorate of NASA/GSFC, and by Century Computing, Inc. in 1980. TAE is an executive program which ties a system of application programs into a single easily operated whole and supports users' operations of programs through a consistent friendly and flexible interactive user interface. TAE also supplies the interface between the user and the various application programs in a particular computer system. It appears to be an effective user interface for infrequent as well as for expert users. Author

N88-15619*# Tennessee Technological Univ., Cookeville. Dept. of Mechanical Engineering.
A NUMERICAL STUDY OF TRANSIENT HEAT AND MASS TRANSFER IN CRYSTAL GROWTH c76
Samuel Bang-Moo Han *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 29 p (For primary document see Summer Faculty Fellowship Program 29 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20L

A numerical analysis of transient heat and solute transport across a rectangular cavity is performed. Five nonlinear partial differential equations which govern the conservation of mass, momentum, energy and solute concentration related to crystal growth in solution, are simultaneously integrated by a numerical method based on the SIMPLE algorithm. Numerical results showed that the flow, temperature and solute fields are dependent on thermal and solutal Grashoff number, Prandtl number, Schmidt number and aspect ratio. The average Nusselt and Sherwood numbers evaluated at the center of the cavity decrease markedly when the solutal buoyancy force acts in the opposite direction to the thermal buoyancy force. When the solutal and thermal buoyancy forces act in the same direction, however, Sherwood number increases significantly and yet Nusselt number decreases. Overall effects of convection on the crystal growth are seen to be an enhancement of growth rate as expected but with highly nonuniform spatial growth variations. Author

N88-15620*# Alabama Univ., Huntsville. Dept. of Chemistry.
USE OF HYDROPHILIC POLYMER COATINGS FOR CONTROL OF ELECTROOSMOSIS AND PROTEIN ADSORPTION c27
J. Milton Harris *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 8 p (For primary document see Summer Faculty Fellowship Program 8 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11B

The purpose of this project was to examine the utility of polyethylene glycol (PEG) and dextran coatings for control of electroosmosis and protein adsorption; electroosmosis is an important, deleterious process affecting electrophoretic separations, and protein adsorption is a factor which needs to be controlled during protein crystal growth to avoid multiple nucleation sites. Performance of the project required use of X-ray photoelectron spectroscopy to refine previously developed synthetic methods. The results of this spectroscopic examination are reported. Measurements of electroosmotic mobility of charged particles in appropiately coated capillaries reveals that a new, one-step route to coating capillaries gives a surface in which electroosmosis is dramatically reduced. Similarly, both PEG and dextran coatings were shown by protein adsorption measurements to be highly effective at reducing protein adsorption on solid surfaces. These results should have impact on future low-g electrophoretic and protein crystal growth experiments. Author

N88-15621*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.
FURTHER STUDY OF INVERSION LAYER MOS SOLAR CELLS c44
Fat Duen Ho *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 16 p (For primary document see Summer Faculty Fellowship Program 16 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 10A

A group of inversion layer MOS solar cells has been fabricated. The highest value of open-circuit voltage obtained for the cells is 0.568V. One of the cells has produced a short-circuit current of 79.6 mA and an open-circuit voltage of 0.54V. It is estimated that the actual area AMO efficiency of this cell is 6.6 percent with an assumed value of 0.75 for its fill factor. Efforts made for fabricating an IL/MOS cell with reasonable efficiencies are reported. Future work for 4 sq cm IL cells and 25 sq cm IL cells is discussed. Author

N88-15622*# New Mexico State Univ., University Park. Dept. of Mathematical Sciences.
CAN SPACE STATION SOFTWARE BE SPECIFIED THROUGH Ada? c61
Arthur Knoebel *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program 22 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

Programming of the space station is to be done in the Ada programming language. A breadboard of selected parts of the work package for Marshall Space Flight Center is to be built, and programming this small part will be a good testing ground for Ada. One coding of the upper levels of the design brings out several problems with top-down design when it is to be carried out strictly within the language. Ada is evaluated on the basis of this experience, and the points raised are compared with other experience as related in the literature. Rapid prototyping is another approach to the initial programming; several different types of prototypes are discussed, and compared with the art of specification. Some solutions are proposed and a number of recommendations presented. Author

N88-15623*# Tennessee Univ., Chattanooga. Dept. of Mechanical Engineering and Mechanics.
THE DETERMINATION OF EQUIVALENT BEARING LOADING FOR THE BSMT THAT SIMULATE SSME HIGH PRESSURE OXIDIZER TURBOPUMP CONDITIONS USING THE SHABERTH/SINDA COMPUTER PROGRAMS c37
Gary H. McDonald *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 23 p (For primary document see Summer Faculty Fellowship Program 23 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 13I

The MSFC bearing seal material tester (BSMT) can be used to evaluate the SSME high pressure oxygen turbopump (HPOTP) bearing performance. The four HPOTP bearings have both an imposed radial and axial load. These radial and axial loads are caused by the HPOTP's shaft, main impeller, preburner impeller, turbine and by the LOX coolant flow through the bearings, respectively. These loads coupled with bearing geometry and operating speed can define bearing contact angle, contact Hertz stress, and heat generation rates. The BSMT has the capability of operating at HPOTP shaft speeds, provide proper coolant flowrates but can only apply an axial load. Due to the inability to operate the bearings in the BSMT with an applied radial load, it is important to develop an equivalency between the applied axial loads and the actual HPOTP loadings. A shaft-bearing-thermal computer code (SHABERTH/SINDA) is used to simulate the BSMT bearing-shaft geometry and thermal-fluid operating conditions.
Author

N88-15624*# Alabama A & M Univ., Huntsville. Dept. of Physics.
ANALYSIS OF RELATIVISTIC NUCLEUS-NUCLEUS INTERACTIONS IN EMULSION CHAMBERS **c72**
Stephen C. McGuire *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 25 p (For primary document see Summer Faculty Fellowship Program 25 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20H

The development of a computer-assisted method is reported for the determination of the angular distribution data for secondary particles produced in relativistic nucleus-nucleus collisions in emulsions. The method is applied to emulsion detectors that were placed in a constant, uniform magnetic field and exposed to beams of 60 and 200 GeV/nucleon O-16 ions at the Super Proton Synchrotron (SPS) of the European Center for Nuclear Research (CERN). Linear regression analysis is used to determine the azimuthal and polar emission angles from measured track coordinate data. The software, written in BASIC, is designed to be machine independent, and adaptable to an automated system for acquiring the track coordinates. The fitting algorithm is deterministic, and takes into account the experimental uncertainty in the measured points. Further, a procedure for using the track data to estimate the linear momenta of the charged particles observed in the detectors is included. Author

N88-15625*# Alabama Univ., Huntsville. Dept. of Chemistry.
RAMAN SPECTROSCOPIC INVESTIGATIONS OF Hg-Cd-Te MELTS **c25**
Anny Morrobel-Sosa *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 38 p (For primary document see Summer Faculty Fellowship Program 38 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 07D

Raman scattering measurements are reported for a series of Hg sub1-xCd subxTe (with x less than or =0.2) materials from 295 K (room temperature) to 1126K (up to and above their liquidus temperatures), and for Hg sub1-xCd subxTe (x=0.3) at 285K. The samples were contained in high-temperature optically-flat fused silica cell. Variable temperature measurements were effected in a three-zone, high-temperature furnace equipped with optical windows, and monitored externally by three independently programmable temperature controllers. All studies were made in the backscattering geometry using the 5145 A line of an Ar+ ion laser, with incident power less than 250 mW, as the excitiation source. An intensity enhancement is observed for a mode in each of the compositions studied. The frequency of this mode varies with composition, 142/cm for HgTe, and 128/cm for both the Hg sub1-xCd subxTe (x=0.053 and 0.204) samples. In addition, a shift to lower frequency as a function of temperature is observed in all samples. This shift is most prominent for the x=0.053 sample. The temperature dependence of these modes as the liquidus temperatures are achieved and surpassed for these samples is presented as being associated with a structural transition in the Hg-rich compositions of the Hg sub1-xCd subxTe series. To our knowledge, this is the first reported study of Raman scattering by phonons in the melts of these materials. Author

N88-15626*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
COMPUTER-AIDED ANALYSIS FOR THE MECHANICS OF GRANULAR MATERIALS (MGM) EXPERIMENT, PART 2 **c31**
Joey K. Parker *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 25 p (For primary document see Summer Faculty Fellowship Program 25 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 13B

Computer vision based analysis for the MGM experiment is continued and expanded into new areas. Volumetric strains of granular material triaxial test specimens have been measured from digitized images. A computer-assisted procedure is used to identify the edges of the specimen, and the edges are used in a 3-D model to estimate specimen volume. The results of this technique compare favorably to conventional measurements. A simplified model of the magnification caused by diffraction of light within the water of the test apparatus was also developed. This model yields good results when the distance between the camera and the test specimen is large compared to the specimen height. An algorithm for a more accurate 3-D magnification correction is also presented. The use of composite and RGB (red-green-blue) color cameras is discussed and potentially significant benefits from using an RGB camera are presented. Author

N88-15627*# Florida Inst. of Tech., Melbourne. Dept. of Physics and Space Science.
IMPROVING THE METHOD OF CALCULATING ELECTRONIC PROPERTIES OF NARROW BANDGAP SEMICONDUCTORS **c76**
James D. Patterson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 28 p (For primary document see Summer Faculty Fellowship Program 28 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20L

A previously developed code for calculating the mobility of charge carriers in narrow bandgap semiconductors does not predict the correct temperature dependence in all cases. It is thought that this is due to the way the electronic screening of the carriers is treated in the model. The objective of this research is to improve the handling of the screening by going beyond the current first Born approximation. Much of this work is directly related to the alloy semiconductor Hg sub 1-xCd sub xTe which is important for infrared detectors and is a good candidate for microgravity crystal growth. The principal conclusion, so far, is that the major difficulty is probably the treatment of short range screening at higher temperatures. Author

N88-15628*# Alabama Univ., Huntsville. Dept. of Computer Science.
EXPERT SYSTEM TECHNOLOGY **c63**
Mary Ellen Prince *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 17 p (For primary document see Summer Faculty Fellowship Program 17 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 09B

The expert system is a computer program which attempts to reproduce the problem-solving behavior of an expert, who is able to view problems from a broad perspective and arrive at conclusions rapidly, using intuition, shortcuts, and analogies to previous situations. Expert systems are a departure from the usual artificial intelligence approach to problem solving. Researchers have traditionally tried to develop general modes of human intelligence that could be applied to many different situations. Expert systems, on the other hand, tend to rely on large quantities of domain specific knowledge, much of it heuristic. The reasoning component

of the system is relatively simple and straightforward. For this reason, expert systems are often called knowledge based systems. The report expands on the foregoing. Section 1 discusses the architecture of a typical expert system. Section 2 deals with the characteristics that make a problem a suitable candidate for expert system solution. Section 3 surveys current technology, describing some of the software aids available for expert system development. Section 4 discusses the limitations of the latter. The concluding section makes predictions of future trends. Author

N88-15629*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
AN INVESTIGATION OF OBLIQUE HYPERVELOCITY IMPACT c39
William P. Schonberg *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 30 p (For primary document see Summer Faculty Fellowship Program 30 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20K

This report describes the results of an investigation of phenomena associated with the oblique hypervelocity impact of spherical projectiles on multi-sheet aluminum structures. A model to be employed in the design of meteoroid and space debris protection systems for space structures is developed. The model consists of equations relating crater and perforation damage of a multi-sheet structure to parameters such as projectile size, impact velocity, and trajectory obliquity. The equations are obtained through a regression analysis of oblique hypervelocity impact test data. This data shows that the response of a multi-sheet structure to oblique impact is significantly different from its response to normal hypervelocity impact. It was found that obliquely incident projectiles produce ricochet debris that can severely damage panels or instrumentation located on the exterior of a space structure. Obliquity effects of high-speed impact must, therefore, be considered in the design of any structure exposed to the hazardous meteoroid and space debris environment. Author

N88-15630*# Arkansas Univ., Little Rock. Dept. of Mechanical Engineering.
EVALUATE THE APPLICATION OF MODAL TEST AND ANALYSIS PROCESSES TO STRUCTURAL FAULT DETECTION IN MSFC - STS PROJECT ELEMENTS c39
William T. Springer *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 25 p (For primary document see Summer Faculty Fellowship Program 25 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20K

The Space Transportation System (STS) is a complex and expensive flight system intended to carry unique payloads into low Earth orbit and return. A catastrophic failure, such as STS 51-L, resulted in the loss of both human life as well as expensive and unique hardware. The impact of this incident reaffirms the need to do everything possible to ensure the integrity and reliability of STS. One means of achieving this goal is to expand the number of inspection technologies available. Reported here is the evaluation of the use of modal analysis and test techniques for the purpose of assessing the structural integrity of STS components for which Marshall Space Flight Center has responsibility. This entailed reviewing existing literature and developing a low-level experimental program determine the feasibility of using this technology for structural fault detection. Author

N88-15631*# Tri-State Univ., Angola, Ind. Dept. of Mechanical and Aerospace Engineering.
TETHER ELEVATOR CRAWLER SYSTEMS (TECS) c18
Frank R. Swenson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 23 p (For primary document see Summer Faculty Fellowship Program 23 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 22B

One of the needs of the experimenters on the space station is access to steady and controlled-variation microgravity environments. A method of providing these environments is to place the experiment on a tether attached to the space station. This provides a high degree of isolation from structural oscillations and vibrations. Crawlers can move these experiments along the tethers to preferred locations, much like an elevator. This report describes the motion control laws developed for these crawlers and the testing of laboratory models of these tether elevator crawlers. Author

N88-15632*# Alabama A & M Univ., Huntsville. Dept. of Mathematics.
PROPULSION ESTIMATION TECHNIQUES c20
Enoch C. Temple *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 14 p (For primary document see Summer Faculty Fellowship Program 14 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 21H

A brief overview of statistical tools needed to perform post flight/test reconstruction of state variables is given. Linear regression, recursive linear regression, and the exact connection between the Kalman filter and linear regression are discussed. The regression connection is expected to serve as an aid in the application of a recently developed analytical method of flight reconstruction to single engine test firing data. Author

N88-15633*# Alabama Univ., Huntsville.
THE DEVELOPMENT OF TEST METHODOLOGY FOR TESTING GLASSY MATERIALS c27
Dennis S. Tucker *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 21 p (For primary document see Summer Faculty Fellowship Program 21 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 11C

The inherent brittleness of glass invariably leads to a large variability in strength data and a time dependence in strength (i.e., static fatigue). Loading rate plays a large role in strength values. Glass is found to be weaker when supporting loads over long periods as compared to glass which undergoes rapid loading. In this instance the purpose of rapid loading is to fail the glass before any significant crack growth occurs. However, a decrease in strength occurs with a decrease in loading rate, pursuant to substantial crack extension. These properties complicate the structural design allowable for the utilization of glass components in applications such as mirrors for the Space Telescope and AXAF for Spacelab and the space station. Author

N88-15634*# California Polytechnic State Univ., San Luis Obispo. Dept. of Metallurgy and Materials Engineering.
EXAMINATION OF THE PHYSICAL PROCESSES ASSOCIATED WITH THE KEYHOLE REGION OF VARIABLE POLARITY PLASMA ARC WELDS IN ALUMINUM ALLOY 2219 c37
Daniel W. Walsh *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 26 p (For primary document see Summer Faculty Fellowship Program 26 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 13I

The morphology and properties of the Variable Polarity Plasma Arc (VPPA) weld composite zone are intimately related to the physical processes associated with the keyhole. This study examined the effects of oxide, halide, and sulfate additions to the weld plate on the keyhole and the weld pool. Changes in both the arc plasma character and the bead morphology were correlated to the chemical environment of the weld. Pool behavior was observed by adding flow markers to actual VPPA welds. A low temperature analog to the welding process was developed. The results of the study indicate that oxygen, even at low partial pressures, can disrupt the stable keyhole and weld pool. The results also indicate that the Marangoni surface tension driven

flows dominate the weld pool over the range of welding currents studied. Author

N88-15635*# Alabama Univ., Huntsville. Dept. of Computer Science.
EXPERT SYSTEM DEVELOPMENT FOR COMMONALITY ANALYSIS IN SPACE PROGRAMS **c66**
Dorian P. Yeager *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 28 p (For primary document see Summer Faculty Fellowship Program 28 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 12B

This report is a combination of foundational mathematics and software design. A mathematical model of the Commonality Analysis problem was developed and some important properties discovered. The complexity of the problem is described herein and techniques, both deterministic and heuristic, for reducing that complexity are presented. Weaknesses are pointed out in the existing software (System Commonality Analysis Tool) and several improvements are recommended. It is recommended that: (1) an expert system for guiding the design of new databases be developed; (2) a distributed knowledge base be created and maintained for the purpose of encoding the commonality relationships between design items in commonality databases; (3) a software module be produced which automatically generates commonality alternative sets from commonality databases using the knowledge associated with those databases; and (4) a more complete commonality analysis module be written which is capable of generating any type of feasible solution. Author

N88-15636*# Auburn Univ., Ala. Dept. of Algebra, Combinatorics and Analysis.
THE JEFFCOTT EQUATIONS IN NONLINEAR ROTORDYNAMICS **c64**
R. A. Zalik *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 37 p (For primary document see Summer Faculty Fellowship Program 37 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 12A

The Jeffcott equations are a system of coupled differential equations representing the behavior of a rotating shaft. This is a simple model which allows investigation of the basic dynamic behavior of rotating machinery. Nolinearities can be introduced by taking into consideration deadband, side force, and rubbing, among others. The properties of the solutions of the Jeffcott equations with deadband are studied. In particular, it is shown how bounds for the solution of these equations can be obtained from bounds for the solutions of the linearized equations. By studying the behavior of the Fourier transforms of the solutions, we are also able to predict the onset of destructive vibrations. These conclusions are verified by means of numerical solutions of the equations, and of power spectrum density (PSD) plots. This study offers insight into a possible detection method to determine pump stability margins during flight and hot fire tests, and was motivated by the need to explain a phenomenon observed in the development phase of the cryogenic pumps of the Space Shuttle, during hot fire ground testing; namely, the appearance of vibrations at frequencies that could not be accounted for by means of linear models. Author

N88-15637# Maryland Univ., College Park. Dept. of Mathematics.
THE PARADOXICAL ASYMPTOTIC STATUS OF MASSLESS SPRINGS
Stuart S. Antman Mar. 1987 34 p
(Grant AF-AFOSR-0073-87)
(AD-A185625; MD87-11-SSA; TR87-11; AFOSR-87-1380TR)
Avail: NTIS HC A03/MF A01 CSCL 20K

The most fundamental problem in the entire theory of oscillations is to describe the motion of a mass point, the tip mass, attached to a spring. Within the classical theory of particle mechanics, the spring is regarded as massless, so that it serves only to transmit a force to the tip mass. This force typically depends on the position and velocity of the tip mass in perhaps a nonlinear way. In this case, the motion is governed by an autonomous ordinary differential equation. On the other hand, if the spring has mass, then its motion as a continuum is coupled to that of the tip mass. If the spring has a nonlinear constitutive equation, then the analysis of the resulting motion, governed by partial differential equations, can be formidable indeed. This paper studies the motion of both tip mass and spring when the mass density of the spring is small and when its constitutive equation describes nonlinearly elastic and viscoelastic materials. Although these constitutive equations do not account for past history, it is nevertheless proven that in the formal limit as the spring's mass density goes to zero the equation for the tip mass is an ordinary differential equation for elastic springs, but is generally not so for viscoelastic springs. GRA

N88-15638# Australian National Univ., Canberra. Research School of Physical Sciences.
HARMONIC EXPANSION FOR THE MAGNETIC FIELD OF THE HELICAL SOLENOID
R. L. Dewar and H. J. Gardner Mar. 1987 31 p
(DE88-700100; ANU/TPP-86/03) Avail: NTIS (US Sales Only)
HC A03/MF A01

The boundary value problem for calculating the scalar magnetic potentials inside and outside of a helically symmetric solenoid is discussed. Under some circumstances the potentials can be expanded in an infinite series of cylindrical harmonics. For a circular cross-section solenoid, we derive a Green's function integral representation of the series coefficients and calculate the radii of convergence of the series by a saddle point method. In some cases the cylinders of convergence can intersect the coil, so that there are physically accessible regions where the series fail to converge. Numerical evidence is presented to show that, even in some of these cases, the potentials can be accurately approximated by finite sums of cylindrical harmonics using boundary collocation. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution*.

N88-15639 Rochester Univ., N. Y.
SOUND PRESSURE DISTRIBUTION IN FRONT OF A SERRATED BOUNDARY: STANDING WAVE SUPPRESSION AND DIFFUSION Ph.D. Thesis
Dennis Fleisher 1987 252 p
Avail: Univ. Microfilms Order No. DA8718934

An experimental investigation was conducted to measure the acoustic pressure distribution produced by a symmetric periodic serrated boundary, in the audio frequency range, and to examine variations of this distribution produced by different frequencies and boundary configurations in the context of architectural acoustics. The nearfield sound pressure distributions produced by reflections of a normally incident monochromatic plane wave from a rigid serrated boundary were measured experimentally using a scale model. Measurements were conducted in the frequency range from 1 to 10 kHz for various angular configuration of symmetric serrated boundaries. The resulting sound pressure distribution data is presented graphically and evaluated on the basis of manifestations of standing wave patterns and diffusion enhancing oblique reflections. Qualitative analyses based on conventional statistical methods and gray-scale texture analysis show good agreement with graphically based classifications. It is found that there is a range of serration angles which produces the greatest suppression of standing waves. It is also found that for large and small serration angles, these desired effects are minimal or absent, or occur only within a limited frequency range. Dissert. Abstr.

N88-15640# Naval Research Lab., Washington, D.C.
THE PROPERTIES OF SOUND PROPAGATION IN LIQUID CONSTRAINED VISCOELASTIC AND POLYMERIC STRUCTURES Interim Report, Jun. 1985 - Jul. 1987
M. P. Horne 9 Oct. 1987 19 p
(AD-A185944; AD-F000114; NRL-MR-6110) Avail: NTIS HC A03/MF A01 CSCL 20A

Detailed experiments were conducted to study the sound propagation in liquids contained by pipes constructed of polymeric materials. In the experiments, vertically aligned cylinders containing water were ensonified at one end by a piston-driven sound source. Approximately 60 dB sound attenuation was observed in pipes constructed of viscoelastic materials, the effect increasing with frequency and loss-tangent. Sound propagation in more rigid polymeric pipes exhibited similar characteristics to that of metallic pipes, in that negligible attenuation was observed. GRA

N88-15641# Nondestructive Testing Information Analysis Center, San Antonio, Tex.
THROUGH-TRANSMISSION/PULSE-ECHO ULTRASONIC EQUIPMENT EVALUATION Final Report, 27 Sep. 1986 - 26 Sep. 1987
Hegeon Kwun 26 Sep. 1987 66 p Prepared in cooperation with Southwest Research Inst., San Antonio, Tex.
(Contract DLA900-84-C-0910)
(AD-A186340; SAALC/MMEI-87-001) Avail: NTIS HC A04/MF A01 CSCL 14B

A literature search was conducted to identify commercially available ultrasonic equipment for nondestructive inspection of bonded structures used in advanced high performance aircraft for flaws such as delaminations, debonds, and impact damage. More than fifty instruments were identified from the search. The majority (approximately 20 percent) of the instruments are based on other techniques such as resonance, acousto-ultrasonic, and so-called shadow techniques. Approximately forty instruments were evaluated, based on the data available from the literature, for their capabilities and limitations. A trend toward the digital, automatic, and computer-controlled instruments was observed. The majority of the commercial instruments are microprocessor-controlled with interfaces for communication with other devices such as an external computer, a printer, a recorder, or a video display. Also, the majority of the instruments is modular in construction to facilitate maintenance and repair. In addition, almost all instruments are equipped with visual and/or audible alarms. GRA

N88-15642# Dortmund Univ. (West Germany). Fachgebiet Qualitaetskontrolle.
ULTRASONIC TESTING OF NEAR-SURFACE ZONES USING SCATTERED SIGNALS Final Report [ULTRASCHALLPRUEFUNG OBERFLAECHENNAHER ZONEN MIT GESTEUERTEN SIGNALEN]
H. A. Crostack, A. Krueger, H. Morlo, and J. Nehring 30 Jun. 1984 90 p In GERMAN
(Contract BMFT-RS-15-00-529)
(ETN-88-90813) Avail: NTIS HC A05/MF A01

Ultrasonic transmitter pulse optimization was investigated in order to improve defect detection sensitivity and defect evaluation of the ultrasonic testing of near-surface zones of nuclear reactor components, such as thin-walled austenitic pipes and platings. The ultrasonic testing with good axial resolution using scattered signals is especially suitable for austenitic components greater than 6mm thick (volumetric testing), as well as for near-surface zones with bad accessibility. Optical holography for the imaging of sound fields allows the testing of thin components with high axial and lateral resolution. Eddy-current testing using controlled signals allows the detection of near-surface defects less than 10 mm, and the testing of near-surfaces zones with high roughness. ESA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N88-15643# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE APPLICATION OF VECTOR DIFFRACTION TO THE SCALAR ANOMALOUS DIFFRACTION APPROXIMATION OF VAN DE HULST M.S. Thesis
Robert W. Mahood May 1987 101 p
(AD-A185930; AD-F000114; AFIT/CI/NR-87-103T) Avail: NTIS HC A06/MF A01 CSCL 20C

The extinction, absorption, and differential scattering cross sections of particles are, in general, functions of the polarization state of the incident radiation; however, this dependency cannot be predicted by van de Hulst's anomalous diffraction approximation because it is a scalar theory. To overcome this deficiency, the Kirchoff and Kirchoff-Kottler vector diffraction formulations were used to modify anomalous diffraction in the hope that polarization effects could then be accounted for. Unfortunately, even with the modification, no polarization dependence was predicted for any of the cross sections. In actuality, the differential scattering cross section did show a second-order polarization dependence, but it was negligible within the limits of the approximation. In addition to the above work, a comprehensive, critical literature review of all previous uses of anomalous diffraction was conducted. In this review, the apparent differences between the Cross and Latimer (1970) and Stephens (1984) anomalous diffraction solutions for the extinction and absorption efficiencies of an infinite cylinder were reconciled. GRA

N88-15644# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
VAN DER WAALS CLUSTERS OF AROMATIC MOLECULES STUDIED USING SUPERSONIC MOLECULAR JET SPECTROSCOPY Ph.D. Thesis
Joseph A. Menapace 1987 349 p
(AD-A186087; AFIT/CI/NR-87-130D) Avail: NTIS HC A15/MF A01 CSCL 07C

Van Der Waals (VDW) clusters of aromatic solutes with various solvents are studied in the gas phase using supersonic molecular jet spectroscopy. Calculations involving ground state cluster binding energy, geometry, and intermolecular vibrational structure are also presented to complement the experiments. The analyses include: spectroscopic studies and theoretical modeling of the intermolecular vibrational structure are also presented to complement the experiments. The analyses include: spectroscopic studies and theoretical modeling of the intermolecular vibronic structure of benzene solvated by argon, methane, water, and ammonia; spectroscopic studies and theoretical modeling of the intermolecular vibronic torsional structure in benzene solvated by methane, deuteromethane, and carbon tetrafluoride; solvation of pyrazine and pyrimidine by both small hydrocarbon and hydrogen bonding solvents; the study of pyrazine and pyrimidine dimers; and the solvation of macrocycles such as free base phthalocyanine (H2Pc) and magnesium phthalocyanine (MgPc) by small hydrocarbon solvents, hydrogen bonding solvents, and carbon dioxide. GRA

N88-15645# Rome Univ. (Italy). Dipt. di Fisica.
RELATIVISTIC CORRECTIONS FOR ONE- AND TWO-PHOTON MATRIX ELEMENTS OF WEAKLY-BOUND SYSTEMS
M. DeSanctis and D. Prosperi 10 Jun. 1987 22 p
(Nota-Interna-884; ETN-88-91245) Avail: NTIS HC A03/MF A01

A complete expansion up to order (1/m sq) for one and two-photon matrix elements is derived, taking into account also the behavior of the wave functions under Lorentz transformations. Lowest order binding energy corrections are inserted in the verification of the low-energy theorem for Compton scattering. Gauge invariance is ensured by extensive use of minimal substitution. ESA

N88-15646# Rome Univ. (Italy). Dipt. di Fisica.
PARTON DENSITIES FROM DEEP INELASTIC SCATTERING TO HADRONIC PROCESSES AT SUPER COLLIDER ENERGIES
M. Diemoz, F. Ferroni, E. Longo, and G. Martinelli (European Organization for Nuclear Research, Geneva, Switzerland) 19 Jun. 1987 70 p Submitted for publication
(Nota-Interna-885; ETN-88-91246) Avail: NTIS HC A04/MF A01

Parton densities were derived from measurements of structure functions in deep inelastic scattering. The difference among the densities reflects the uncertainties from deep inelastic data of different experiments, allowing an estimate of the error band for the predictions for any given hadronic process at higher energy. The densities are available at any scale Q sq less than or = 5 billion GeV and X less than or = 0.00001 and include next to leading corrections as well as threshold effects due to heavy flavors. A comparison with a large set of data in a wide range of scales is also presented. ESA

N88-15647# Rome Univ. (Italy). Dipt. di Fisica.
A SIMPLIFIED MODEL OF ELEMENTARY PARTICLES [SU UN MODEL LO SEMPLIFICATO DI PARTICELLA ELEMENTARE]
L. Chiatti 9 Jul. 1987 156 p In ITALIAN
(Nota-Interna-890; ETN-88-91251) Avail: NTIS HC A08/MF A01

A model assuming that the elementary particles are not objects in motion, but motions in a Minkowsky space time is described. The idea, which attempts to overcome difficulties found in the relativistic quantum theory, is formalized, establishing that space-time is filled with a substratum (ether) which is relativistically invariant and composed of instantaneous motions. An elementary particle is defined as one of the paths in this space. The most important characteristic of the model is that the wave function is introduced as a purely mathematical device linked to a probability value. ESA

N88-15648# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ATOMIC CLOCKS RESEARCH: AN OVERVIEW
Robert P. Frueholz, Natarajan D. Bhaskar, James C. Camparo, Bernardo Jaduszliwer, and Charles M. Klimcak 15 Aug. 1987 48 p
(Contract F04701-85-C-0086)
(AD-A185567; TR-0086A(2945-05)-1; SD-TR-87-47) Avail: NTIS HC A03/MF A01 CSCL 14B

The primary objective of the program is to improve the reliability and performance of the atomic frequency standards used on Air Force satellites. The investigations maintain broad expertise across the range of traditional standards, rubidium and cesium, as well as develop expertise in standards with potential satellite applications, for example the hydrogen maser and the stored-ion standard. Several areas associated with improving the performance and reliability of the rubidium standard are under investigation: analytical modeling of clock frequency stability; the orgins of frequency drift; advanced, laser-based optical pumping techniques; and discharge lamp reliability. Our primary concern with the cesium standard involves improving the reliability of compact, satellite compatible designs. Topics currently being studied include graphite gettering of expended cesium, electron multiplier gain decay processes, and cesium oven performance. Investigations aimed at improving hydrogen maser performance include study of the motional narrowing process, which yields the narrow hyperfine resonance feature upon which maser operation is based; and characterization of hydrogen dissociator performance in terms of hydrogen consumption and the velocity distribution of the emitted hydrogen atoms. GRA

N88-15649# Naval Research Lab., Washington, D.C.
PHOTOIONIZATION OF ATOMS AND IONS: APPLICATION OF TIME-DEPENDENT RESPONSE METHOD WITHIN THE DENSITY FUNCTIONAL THEORY Interim Report
U. Gupta, J. Davis, and M. Blaha 13 Oct. 1987 40 p
(Grant MIPR-DGAM-60091)
(AD-A185686; NRL-MR-6089) Avail: NTIS HC A03/MF A01 CSCL 20E

The photoionization cross-section of several atoms (Ar, Xe, Rn, Cs) and ions (Ne-like Ar, H-like and Li-like C) of experimental interest are calculated using the time-dependent response scheme within the framework of local density functional method (DFM). The cross-sections for rare gas atoms calculated using this method agree very well with the experimental data; whereas conventional independent particle model do not. The polarization effect of the atom brought about by the incident time varying radiation field is shown to be important in describing observed results. Unlike the independent particle model, this effect is treated adequately in the DFM. To study the effect plasma density and temperature on the photoionization cross-section, calculations were also done for the ions mentioned above at various densities and temperatures. For computational simplicity, a simplified model of self-consistent finite temperature DFM was used in which the long range part of the ionic potential was taken as the Debye-screened potential. These calculations were compared with the isolated ion calculations (without any plasma effect). With increasing plasma density, significant shifts of the ionization threshold as well as substantial modifications of photoionization cross-section are obtained. This points out the need for incorporating the effect of surrounding plasma in realistic modeling of atomic properties for dense plasmas. GRA

N88-15650# California Univ., Berkeley. Lawrence Berkeley Lab.
THE COUPLED CLUSTER SINGLE AND DOUBLE EXCITATION (CCSD) METHOD IN QUANTUM CHEMISTRY: AN EFFICIENT FORMULATION OF THE THEORY AND APPLICATION TO CLOSED SHELL MOLECULAR SYSTEMS Ph.D. Thesis
A. C. Scheiner Aug. 1987 158 p
(Contract DE-AC03-76SF-00098)
(DE88-000475; LBL-23923) Avail: NTIS HC A08/MF A01

The first chapter discusses successes and outstanding problems in quantum chemistry, the electron correlation problem (the configuration interaction and the coupled cluster approaches), and the truncation of the many-electron expansion. The second chapter gives an efficient formulation of the closed-shell CCSD equations and discusses their application to N2, H2O, H3O(+), H5O2(+), HSOH, and s-tetrazine (C2N4H2). The third chapter is a theoretical study of the electronic states and photodissociation of s-tetrazine. The fourth (and final) chapter gives an efficient formulation of the closed-shell CCSD energy gradient equations, and applies it to the H2O and H2CO molecules. DOE

N88-15651# Oak Ridge National Lab., Tenn.
CORRELATION EFFECTS ON DOUBLE ELECTRON CAPTURE IN HIGHLY-CHARGED, LOW-ENERGY ION-ATOM COLLISIONS
F. W. Meyer, D. C. Griffin, C. C. Havener, M. S. Huq, R. A. Phaneuf, J. K. Swenson, and N. Stolterfoht 1987 11 p Presented at the 15th International Conference on the Physics of Electronic and Atomic Collisions, Brighton, United Kingdom, 22 Jul. 1987 Prepared in cooperation with Hahn-Meitner-Institut fuer Kernforschung, Berlin, Fed. Republic of Germany
(Contract DE-AC05-84OR-21400)
(DE87-013179; CONF-870715-4) Avail: NTIS HC A03/MF A01

The method of zero-degree Auger electron spectroscopy has been used to study two-electron excited states populated in slow double capture collisions of highly charged ions with He and H sub 2. The focus of this study is on production of autoionization electrons originating from the non-equivalent 1s (2) 2 pnl electron configurations in comparison with electron production resulting from the Auger decay of (near) equivalent 1s(2) 2 pnl (with n approx. n') configurations. It is shown that production of non-equivalent electron configurations is significant and involves electron-electron correlation effects whose analysis leads beyond the independent-particle model. Recent results that include a measurement at non-zero angles are presented to illustrate the angular dependence of electron emission from non-equivalent electron configurations, as well as the dependence on projectile charge state and target species. Comparison of high resolution

scans over two lines of the 1s(2) 2pnl sequence for the O(6+)+He system with accurate transition energy calculations shows preferential population of high angular momentum substation.
DOE

N88-15652# California Inst. of Tech., Pasadena. Dept. of Physics.
DOUBLE BETA DECAY AND NUCLEAR STRUCTURE
P. Vogel 1986 8 p Presented at the Recontres De Moriond Workshop on Massive Neutrinos in Particle Physics and Astrophysics, Tignes, Savoie, France, 25 Jan. 1986
(Contract DE-AS03-81ER-40002)
(DE88-001966; CALT-63-462; CONF-860167-8) Avail: NTIS HC A02/MF A01

The decay rate of the 2 nu double beta decay is calculated as a test of our understanding of the nuclear structure problems involved. The effects of pairing, static quadrupole deformation, spin-isospin polarization, and the isobar admixtures are analyzed. The calculation, which is parameter free, predicts a faster decay rate than has been observed experimentally in Se-82, Te-130, and Nd-150. DOE

N88-15653# California Inst. of Tech., Pasadena. Dept. of Physics.
THEORY OF DOUBLE BETA DECAY
P. Vogel 1986 4 p Presented at the 23rd International Conference on High-Energy Physics, Berkeley, Calif., 16 Jul. 1986
(Contract DE-AS03-81ER-40002)
(DE88-002285; CALT-63-490; CONF-860701-90) Avail: NTIS HC A02

The nuclear matrix elements for 2 nu double beta decay is calculated. It is shown that the decay matrix element passes through zero as a function of the coupling constant, g(sup pp), of the particle-particle component of the spin-isospin polarization force, neglected previously. The analysis of EC/Beta(+) decay rates for semi-magic nuclei suggests values for g(sup pp) in the very vicinity of this zero, thereby yielding long lifetimes and providing a possible resolution of the longstanding discrepancy between calculated and measured 2 nu double beta decay rates. DOE

N88-15654# Amsterdam Univ. (Netherlands). Faculteit der Wiskunde en Natuurwetenschappen.
ELECTRON SCATTERING OFF PALLADIUM ISOTOPES. AN INVESTIGATION OF THE EQUIVALENCE OF THE ANHARMONIC VIBRATOR MODEL AND THE INTERACTING BOSON MODEL Ph.D. Thesis
Joannes Benedictus vanderLaan 1987 108 p Sponsored by the Foundation for Fundamental Research on Matter, and the Netherlands Organization for the Advancement of Pure Research
(B8671274; ETN-88-91359) Avail: NTIS HC A06/MF A01

The results of an electron scattering experiment on Pd isotopes, designed to study the description of such nuclei in the anharmonic vibrator model (AVM) and the interacting boson approximation (IBA) are discussed. Transition charge densities are constructed in IBA with boson structure functions which resemble the first and second-derivative like shape predicted for the one and two-phonon transitions in the AVM. The main difference is that in the AVM the strength to each state has to be determined by the experiment, whereas in the IBA the relative strengths are predicted and all transitions with the same angular momentum are described with the same operator. The advantage of the IBA is the general description of nuclei over a broad mass region covering vibrators, rotors, and gamma-unstable rotors and the transitional classes between them. ESA

N88-15655# Amsterdam Univ. (Netherlands). Faculteit der Wiskunde en Natuurwetenschappen.
STUDY OF TAU PAIRS AND SEARCH FOR NEW PARTICLES Ph.D. Thesis
Marcellinus Wilhelmu Demarteau 1986 101 p Sponsored by the Foundation for Fundamental Research on Matter
(B8680488; ETN-88-91360) Avail: NTIS HC A06/MF A01

Pair production of tau leptons in e(+) e(-) collisions was studied. The characteristics of events originating from the production of new particles and the selection criteria used in the search for these particles are described. No candiates for new particles are found. Sequential heavy leptons are excluded to a mass of 22.4 GeV. The production of charged Higgs bosons with a mass between 4 and 16 GeV is excluded if the branching ratio of the charged Higgs boson to the tau is greater than 25 percent. The lower limit on the mass of scalar taus, the supersymmetric partners of the tau-lepton, is 17 GeV. Winos are excluded with a mass less than 23 GeV, a result which is very insensitive to the scalar neutrino mass, unless the scalar neutrino and the wino are almost degenerate in mass. Higgsinos are excluded to a mass of 22.3 GeV for both a right-handed and a left-handed coupling at the higgsino-photino-W-boson vertex. ESA

N88-15624*# Alabama A & M Univ., Huntsville. Dept. of Physics.
ANALYSIS OF RELATIVISTIC NUCLEUS-NUCLEUS INTERACTIONS IN EMULSION CHAMBERS
Stephen C. McGuire *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 25 p (For primary document see Summer Faculty Fellowship Program 25 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N88-15656# European Organization for Nuclear Research, Geneva (Switzerland).
ACCELERATORS AND SUPERCONDUCTIVITY: A MARRIAGE OF CONVENIENCE. SECOND JOHN ADAMS MEMORIAL LECTURE
Martin Wilson 1 Jun. 1987 20 p Lecture held in Lausanne, Switzerland, 27 Nov. 1986
(DE88-700005; CERN-87-06; CONF-8611202-1) Avail: NTIS (US Sales Only) HC A03/MF A01

This lecture deals with the relationship between accelerator technology in high-energy-physics laboratories and the development of superconductors. It concentrates on synchrotron magnets, showing how their special requirements have brought about significant advances in the technology, particularly the development of filamentary superconducting composites. Such developments have made large superconducting accelerators an actuality: the Tevatron in routine operation, the Hadron Electron Ring Accelerator (HERA) under construction, and the Superconducting Super Collider (SSC) and Large Hadron Collider (LHC) at the conceptual design stage. Other applications of superconductivity have also been facilitated - for example medical imaging and small accelerators for industrial and medical use.
DOE

N88-15657# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
ON A POSSIBILITY OF ION ACCELERATION UP TO HIGH ENERGIES IN A HIGH-CURRENT ELECTRON BEAM
A. G. Bonch-Osmolovskij and K. A. Reshetnikova 1986 4 p In RUSSIAN
(DE88-700532; JINR-R-9-86-586) Avail: NTIS (US Sales Only) HC A02/MF A01

A possibility of accelerating ions up to relativistic velocities in the high-current electron beam is investigated. By analytical and numerical methods of solving a self-consistent system of equations in hydrodynamical approximation it is shown that an external HF-generator can excite in the structure with the beam fast Langmuir waves of high intensity. Phase velocity of this wave is

larger than that of the electrons but less than the velocity of light. Ion acceleration rate may constitute 30-40 MeV/m under the following electron beam parameters: current approx. 1 kA, energy-250-300 keV. The change of phase velocity with the ion velocity increase may be conducted through changing such geometric parameters as waveguide wall dielectric coating thickness. A basically important feature of this method, consisting of the acceleration of a high-current ion beam (J/sub i/approx. =IA), is retained under ion injection from a slow wave section into one with a fast wave. This offers a possibility of beam colliding for example, pp, pd etc., with the energy of 2 x 10 GeV and higher with a considerable luminosity. DOE

N88-15658# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
EXPERIMENTAL RESEARCH OF ELECTRON BEAM INSTABILITY ON THE DOPPLER ANOMALOUS EFFECT
D. V. Gorozhanin and B. I. Ivanov 1987 6 p In RUSSIAN
(DE88-700565; KFTI-87-6) Avail: NTIS (US Sales Only) HC A02/MF A01

Beam instability caused by the Doppler anomalous effect (DAE) at electron beam interaction with the decelerating electrodynamic system (a resonator with a single-thread spiral and a resonator with a space-periodic structure) placed in the external homogeneous field are studied experimentally to investigate main mechanisms of instability of charged particle beams. Such general properties of DAE as resonance conditions for instability excitation, increase of the internal energy of oscillators (Larmor and Langmuir) during radiation, energy ratios for slow cyclotron and plasma waves of an electron beam are studied. Good agreement between experimental and theoretical results is obtained. DOE

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N88-15659# Schwartz Electro-Optics, Inc., Concord, Mass.
CHARACTERIZATION OF Er,Cr:YSGG Final Report, 1 Jul. - 31 Dec. 1986
Peter F. Moulton 3 Jun. 1987 36 p
(Contract F49620-86-C-0074)
(AD-A185885; AFOSR-87-1166TR) Avail: NTIS HC A03/MF A01 CSCL 09C

A study of the spectroscopic and laser properties of the crystal erbium-and chromium-doped yttrium scandium gallium garnet (Er,Cr:YSGG) has been carried out. The absorption spectra from 300 to 1700 nm and the emission spectra in the regions around 800, 1600 and 2800 nm have been measured, along with the kinetics of emission and decay under pulsed excitation. Energy levels of the erbium ion have been determined. Analysis of the data shows that energy transfers from excited chromium ions to erbium ions with near-100 percent efficiency. The 2800-nm-region laser performance of Er,Cr:YSGG, under flashlamp pumping conditions has been observed and found to be superior in some aspects to other erbium-doped crystals. GRA

N88-15660# Arizona Univ., Tucson. Coll. of Engineering and Mines.
FEASIBILITY STUDIES OF OPTICAL PROCESSING OF IMAGE BANDWIDTH COMPRESSION SCHEMES Final Report, 15 Mar. 1981 - 30 Sep. 1985
B. R. Hunt 15 May 1987 213 p Supersedes AD-A181720
(Grant AF-AFOSR-0170-81)
(AD-A186073; AFOSR-87-0768TR) Avail: NTIS HC A10/MF A01 CSCL 20F

The two research activities are included as two separate divisions of this research report. The research activities are as follows: 1. Adaptive Recursive Interpolated DPCM for image data compression (ARIDPCM). A consistent theme in the search supported under Grant Number AFOSR under Grant AFOSR-81-0170 has been novel methods of image data compression that are suitable for implementation by optical processing. Initial investigation led to the IDPCM method of image data compression. 2. Deblurring images through turbulent atmosphere. A common problem in astronomy is the imaging of astronomical fluctuations of the atmosphere. The microscale fluctuations limit the resolution of any object by ground-based telescope, the phenomenon of stars twinkling being the most commonly observed form of this degradation. This problem also has military significance in limiting the ground-based observation of satellites in earth orbit. As concerns about SDI arise, the observation of Soviet Satellites becomes more important, and this observation is limited by atmospheric turbulence. GRA

N88-15661# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
RECOGNITION OF POLYHEDRAL OBJECTS UNDER STRUCTURED ILLUMINATION
G. A. Weller, A. Choudry, L. O. Hertzberger, and G. R. Meijer Oct. 1986 8 p
(PB88-106703; FVI-86-28) Avail: NTIS HC A02/MF A01 CSCL 20F

Using suitable structured light for scene illumination, the problem of recognizing 3D-objects from 2-D images can be overcome. A system is presented to simulate the image of a scene using structured light, as it is seen from an arbitrarily placed camera. Algorithms are developed to determine the orientation of the visible faces of an object without reconstructing the 3D scene. These features are used to classify the object. The consequences of perspective deformation and pixel-errors which occur in a realistic situation, were studied. GRA

N88-15662# Oak Ridge National Lab., Tenn.
FIBER OPTICS REFRACTOMETER FOR ABSORPTION MACHINES
D. A. Bostick, L. N. Klatt, and H. Perez-Blanco 1987 18 p Presented at the Heat Transfer Symposium, Urbana, Ill., 1 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE88-002296; CONF-8710194-1) Avail: NTIS HC A03/MF A01

Monitoring solution concentration in lithium bromide absorption units is of great importance to improve the thermal efficiency and the controllability of the units. The conventional way to measure concentration in lithium bromide water absorption machines is by means of refractometers. This technique requires the extraction of a sample from the machine. In situ, real time measurements are then difficult, and implementing control strategies is impossible. The fiber optic refractometer described in this work is capable of monitoring concentration in situ, giving instantaneous readings. The device consists of light sources, light detectors, and fiber optics with a surface treatment that enables them to measure the index of refraction of the solution. The instrument is described and results showing its usefulness presented. DOE

N88-15663# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR).
DEVELOPMENT AND STUDY OF FIBRE-OPTIC LINK LINES ON THE BASIS OF THE KEM-8-4PD, KEM-8-4PR QUANTUM-ELECTRONIC MODULES
I. B. Bojko, M. V. Bojko, B. Ya. Gerasimov, N. E. Detinenko, S. I. Pilipenko, and S. K. Tokarev 1986 10 p In RUSSIAN
(DE88-700372; IFVE-OEA-86-105) Avail: NTIS (US Sales Only) HC A02/MF A01

The method of adjustment of the cable part of optical demontable connectors using the non-precise eccentric elements, the method of extending optical cables several kilometers long with splice machine's aid, the technical means to evaluate the elements of fibre-optic link lines (FOLL) are described. The example of the FOLL application on the basis of KEM-8-4PD for synchropulses transmission to control of the preinjector of the I-100 linear accelerator is given. DOE

N88-15576# Joint Publications Research Service, Arlington, Va.
PHASE PHENOMENA IN PARAMETRIC GENERATORS AND AMPLIFIERS OF ULTRASHORT LIGHT PULSES Abstract Only
A. Piskarkas, A. Stabinis, and A. Yankauskas *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 13 Transl. into ENGLISH from Uspekhi Fizicheskikh Nauk (Moscow, USSR), v. 150, no. 1, Sep. 1986 p 127-143 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15590# Joint Publications Research Service, Arlington, Va.
PROPAGATION OF RADIATION ALONG A CONSTRICTING OPTICAL WAVEGUIDE Abstract Only
V. M. Andreyev, K. F. Yeskin, and Ye. Ye. Glukhova *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 41 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 2, Aug. 1986 p 432-434 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15591# Joint Publications Research Service, Arlington, Va.
CROSS SECTION OF RESONANT RAMAN SCATTERING OF LIGHT BY POLYENES Abstract Only
V. V. Verdyugin, K. Ya. Burshteyn, and P. P. Shorygin *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 41-42 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 2, Aug. 1986 p 299-302 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

N88-15592# Joint Publications Research Service, Arlington, Va.
SOLITON MODE OF PROPAGATION OF LIGHT PULSES THROUGH SINGLE-MODE OPTICAL FIBERS AND PROBLEMS OF ITS EXPERIMENTAL REALIZATION Abstract Only
V. Yu. Petrunkin, A. V. Selishev, V. M. Sysuyev, and A. S. Shcherbakov *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 51-52 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 16, 26 Aug. 1986 p 988-991 (For primary document see N88-15575 07-70)
Avail: NTIS HC A05/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N88-15664# National Academy of Sciences - National Research Council, Washington, D. C.
ADVANCED FUSION POWER: A PRELIMINARY ASSESSMENT Final Report, 1986 - 1987
George H. Miley, Herbert L. Berk, David C. Cartwright, Robert F. Christy, and Nathan J. Hoffman Oct. 1987 56 p
(Contract F49620-85-C-0107)
(AD-A185903) Avail: NTIS HC A04/MF A01 CSCL 18A

This report is a review of research and studies of fusion with low neutron emission (advanced) fuels (such as Deuterium with Helium 3); it is an assessment of the feasibility of developing advanced fuels as a fusion power source for space propulsion and electrical power generation. GRA

N88-15665# Naval Research Lab., Washington, D.C.
HIGH MIDPLANE ACCESSIBILITY STELLARATOR WINDINGS FOR HIGH CURRENT TOROIDAL ACCELERATORS
S. J. Marsh, J. Golden, C. A. Kapetanakos, and D. Anderson 6 Oct. 1987 33 p
(AD-A186235; NRL-MR-6025) Avail: NTIS HC A03/MF A01 CSCL 20G

We have developed two strong focusing field configurations that provide high midplane accessibility and therefore are compatible with presently contemplated extraction schemes for high current, toroidal accelerators. When these windings are attached to a modified betatron accelerator, the bandwidth of the device is slightly smaller than the bandwidth of a modified betatron with unsplit stellarator windings. However, the bandwidth of the two new configurations is more than sufficient even for modest (20-30 kA) winding current. GRA

N88-15666# Tennessee Univ., Tullahoma.
LASER THERMAL PROPULSION Final Report, 1 Jan. 1983 - 31 Aug. 1986
Dennis Keefer 5 Jun. 1987 9 p
(Grant AF-AFOSR-0043-83)
(AD-A186407; AFOSR-87-1270TR) Avail: NTIS HC A02/MF A01 CSCL 21C

The objective of this research investigation was to determine, experimentally and analytically, the physical mechanisms that control the behavior of continuous, laser sustained plasmas. The principle questions involve the effects of a forced convection environment and optical geometry on the stability, fractional power absorption, plasma structure, and fluid mixing. A continuous, 1.5 kW, axial flow, carbon dioxide laser was used to create the LSP in a cylindrical quartz flow channel. The convection flowfield surrounding the plasma was controlled by the volume flow through the test chamber, and the optical geometry was determined by the unstable oscillator output mode of the laser and the focal length of the lens. Digital images of the plasma in a selected narrow wavelength interval were obtained using a CID digital camera and a VICOM digital image processing computer that were calibrated for absolute radiance. These images were then Abel inverted to give a spatial plasma emission coefficient which determined the spatial distribution of the plasma temperature. These measured temperature fields were then used to calculate the laser power absorption in the plasma and the power lost from the plasma through optically thin emission. More than one hundred sets of data were obtained for argon plasmas at nominal pressures from 1.5 to 3 atmospheres and incident flow velocities from 0.4 to 4.0 m/s. GRA

N88-15667# Helsinki Univ. of Technology, Espoo (Finland).
STUDIES ON PARAMETRIC INSTABILITIES IN HIGH-FREQUENCY WAVE HEATING OF FUSION PLASMAS Ph.D. Thesis
Jukka Heikkinen 1987 30 p
(Ph-156; ISBN-951-666-240-4; ISSN-0355-2721; ETN-88-90733)
Avail: NTIS HC A03/MF A01

The effect of secondary wave coupling mechanism on parametric instabilities in plasmas for fusion applications was investigated. Harmonic generation of the low-frequency wave is found to reduce well the reflectivity of Brillouin scattering and to suppress the convective growth of the lower hybrid decay instability. Saturation of Raman scattering by ion wave coupling of the low-frequency mode is also obtained. A very complicated (apparently chaotic) time behavior for weakly damped waves is observed, illustrating the strong nonlinearity inherent in the wave equation systems. The linear threshold for the parametric scattering of the heating wave in electron-cyclotron resonance heating of tokamak plasma was studied. ESA

N88-15668# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[ACTIVITIES REPORT OF THE INSTITUTE OF PLASMA PHYSICS] Annual Report, 1986
1986 20 p
(ETN-88-91020) Avail: NTIS HC A03/MF A01

Research concerning electron cyclotron resonance heating; plasma theory; laser diagnostics; plasma focus; and stellarators is summarized. ESA

N88-15669# Lawrence Livermore National Lab., Calif.
MIRROR THEORY APPLIED TO TOROIDAL SYSTEMS
R. H. Cohen 25 Aug. 1987 18 p Presented at the Course and Workshop on Physics of Mirrors, Reversed Field Pinches and Compact Tori, Varenna, Italy, 1 Sep. 1987
(Contract W-7405-eng-48)

(DE88-000217; UCRL-96672; CONF-870908-6) Avail: NTIS HC A03/MF A01

Central features of a mirror plasma are strong departures from Maxwellian distribution functions, ambipolar potentials and densities which vary along a field line, end losses, and the mirror field itself. To examine these features, mirror theorists have developed analytical and numerical techniques to solve the Fokker-Planck equation, evaluate the potentials consistent with the resulting distribution functions, and assess the microstability of these distributions. Various combinations of mirror-plasma features are present and important in toroidal plasmas as well, particularly in the edge region and in plasmas with strong RF heating. In this paper we survey problems in toroidal plasmas where mirror theory and computational techniques are applicable, and discuss in more detail three specific examples: calculation of the toroidal generalization of the Spitzer-Haerm distribution function (from which trapped-particle effects on current drive can be calculated), evaluation of the nonuniform potential and density set up by pulsed electron-cyclotron heating, and calculation of steady-state distribution functions in the presence of strong RF heating and collisions. DOE

N88-15670# California Univ., Berkeley. Electronics Research Lab.

PLASMA THEORY AND SIMULATION Quarterly Progress Report, 1 Jul. - 31 Dec. 1986

C. K. Birdsall 1986 71 p

(Contract DE-FG03-86ER-53220)

(DE88-000412; DOE/ER-53220/T2; QPR-3; QPR-4) Avail: NTIS HC A04/MF A01

Theory and simulation are used as tools to increase understanding of plasma instabilities, heating, transport, plasma-wall interactions, and large potentials in plasmas. The improvement of simulation is considered, both theoretically and practically. Two separate papers are included in this report. DOE

N88-15671# Lawrence Livermore National Lab., Calif.

THE APPLICATION OF PHOTOCONDUCTIVE DETECTORS TO THE MEASUREMENT OF X-RAY PRODUCTION IN LASER PRODUCED PLASMAS

D. R. Kania, P. Bell, and J. Trebes Aug. 1987 13 p Presented at the 31st SPIE Annual International Technical Symposium on Optical and Optoelectronic Applied Science and Engineering, San Diego, Calif., 16 Aug. 1987

(Contract W-7405-eng-48)

(DE88-001630; UCRL-97491; CONF-8708110-26) Avail: NTIS HC A03/MF A01

Photoconductive detectors (PCDs) offer an attractive alternative for the measurement of pulsed X-rays from laser produced plasmas. These devices are fast (FWHM approx. 100 ps), sensitive and simple to use. We have used InP, GaAs, and Type IIa diamond as PCDs to measure X-ray emission from 100 eV to 100 keV. Specifically, we have used these detectors to measure total radiation yields, corona temperatures, and hot electron generated X-rays from laser produced plasmas. DOE

N88-15672# Oak Ridge National Lab., Tenn.

POLOIDAL MAGNETICS OF COMPACT IGNITION TOKAMAKS

D. J. Strickler, Y. K. M. Peng, and J. D. Galambos 1986 17 p Presented at the American Physical Society Plasma Physics Division Meeting, Baltimore, Md., 3 Nov. 1986

(Contract DE-AC05-84OR-21400)

(DE88-001774; CONF-861110-4) Avail: NTIS HC A03/MF A01

The present compact ignition tokamak (CIT) design point (R = 1.225 m, a = 0.454 m, B = 10.4 T, I = 10 MA) is optimized with respect to device size for limiter operation. The CIT poloidal field (PF) system is designed for both limiter and divertor (at I = 9 MA) scenarios. Forming a poloidal separatrix within the limiter vacuum chamber requires a divertor plasma elongation kappa = 2.0 and almost twice the PF energy as the limiter case. This study examines the dependence of PF system characteristics on the plasma elongation within the context of design points optimized for divertor operation. It is shown that higher elongation kappa = 2.0 considerably simplifies the CIT poloidal magnetic systems subject to device design constraints. DOE

N88-15673# Colorado Univ., Boulder.

REVERSED FIELD PINCH EXPERIMENTS: SUMMARY OF PROGRESS REPORT

S. Robertson 1987 4 p

(Contract DE-FG02-87ER-53244)

(DE88-002367; DOE/ER-53244/1) Avail: NTIS HC A02/MF A01

The purpose of the Reversatron experiment is to determine the role of the shell in Reversed Field Pinch (RFP) confinement. In 1987 three experimental studies were completed: a study of the RFP operated as a spheromak of high aspect ratio, a study of a modular shell, and a study of dynamo activity in ultra-low-q tokamak discharges. In addition, a new front end for the Reversatron experiment has been constructed and is ready for testing. These experimental studies are summarized. DOE

N88-15674# Australian National Univ., Canberra. REsearch School of Physical Sciences.

FREE-BOUNDARY EQUILIBRIUM PROBLEM FOR HELICALLY SYMMETRIC PLASMAS

H. J. Gardner, R. L. Dewar, and W. N.-C. Sy May 1987 19 p Submitted for publication

(DE88-700101; ANU/TPP-86/02) Avail: NTIS (US Sales Only) HC A03/MF A01

An iterative technique for solving the ideal MHD equilibrium equations for a helically symmetric plasma with a free boundary is described. The method involves an application of Green's theorem and has been formulated for the geometry of a heliac. It is used to determine a stability diagram for the SHEILA heliac as a function of the plasma pressure and the current in one of the external coils. DOE

N88-15675# Paris Univ., Orsay (France). Lab. de Physique des Gaz et des Plasmas.

INTERACTION BETWEEN A MODULE CLUSTER AND A PLASMA IN A MAGNETIC FIELD Final Report

1986 17 p In FRENCH Sponsored by Direction des Recherches, Etudes et Techniques, Paris, France

(PB87-148276) Avail: NTIS HC E03/MF E03 CSCL 20I

The contract concerned the construction and improvement of an experiment of interaction between an electron cluster and a magnetized plasma with the goal of testing the use of a modulated electron cluster as an emission antenna. The project falls within the framework of previous studies dealing with a theoretical evaluation of the output of such an antenna. It has become apparent, in fact, that the power radiated by the cluster, such as it can be calculated in a linear regime, is too great for the result to be physically credible. In addition to verification of the excitation principle, the experiment must provide elements on the saturation mechanism. The saturation will finally establish the maximum value of the radiated power. A decision on continuing the EPITRE project will depend on these experimental studies. The casing experiment will make it possible to specify the parameters of an experiment on a rocket or satellite, and facilitate its analysis. The construction phase of the casing and the electron cannon as well as their implantation was completed. What remains to produce is a plasma in the casing and to study there the modulated magnetized plasma-cluster interaction. GRA

N88-15676# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.

THE EFFECT OF PROPANE ON ATOMIC SPECTROMETRIC SIGNALS IN THE DIRECT CURRENT PLASMA

T. W. McCreary and G. L. Long 1987 26 p Presented at the 14th Federation of Analytical Chemistry and Spectroscopy Societies (FACSS), Detroit, Mich., 1 Oct. 1987

(Contract DE-FG22-85PC-80532)

(DE88-002457; DOE/PC-80532/10; CONF-8710209-1) Avail: NTIS HC A03/MF A01

The addition of small amounts of propane to the direct current plasma, DCP, affects the emission signal of analyte species in the plasma. In the normal analytical region of the plasma, a reduction in emission is seen; this reduction can be accounted for by a decrease in excitation temperature caused by the propane in this region of the plasma. Above the analytical region, an enhancement in atomic emission is seen. The excitation temperature in this region of the plasma was found to remain unchanged when propane was added. The mechanism for the enhancement is thought to be the reduction of metal oxides to the corresponding free metal by carbon. Evidence for the mechanism is provided by the fact that a large reservoir of atomic carbon exists in this region of the plasma, and by examination of the behavior of slurries of the metal oxides, introduced into the plasma via a Babington nebulizer. DOE

N88-15677# Bhabha Atomic Research Centre, Bombay (India).
PULSED POWER SOURCES BASED ON MHD GENERATORS (A STATE-OF-ART REVIEW)
A. K. Das, N. Venkatramani, and V. K. Rohatgi 1986 95 p
(DE88-700296; BARC-1322) Avail: NTIS (US Sales Only) HC A05/MF A01

Pulsed power sources are finding increased applications in powering plasma experiments, CTF devices, investigations of structure of earth's crust or self-contained compact power supplies for military applications. This report reviews the development of magnetohydrodynamic (MHD) power systems for pulsed power applications. The major critical components, which are analysed in detail, include the combustor, high energy fuel development, high field magnet, high power density channel and power conditioning unit. The report concludes that the MHD research has now reached a stage, where it is possible to design and achieve requisite performance from short duration high power compact MHD generators. DOE

N88-15678# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoh Ehnergii.
METHOD OF PLASMA DIAGNOSTICS BY A HEAVY ION BEAM FOR THE T-15 TOKAMAK
L. I. Krupnik, A. V. Melnikov, and I. S. Nedzelskij 1986 25 p In RUSSIAN
(DE88-700342; IAE-4297/7) Avail: NTIS (US Sales Only) HC A03/MF A01

Possibilities of using method of plasma diagnostics by heavy ion beams for measurement of plasma parameters the T-15 tokamak were discussed. Basic parameters of probing beams were determinded, various schemes of the experiment were suggested, the description of the necessary measurement equipment was given. The method is based on accelerated ion beam injection into a plasma in the plane perpendicular to the direction of confining magnetic field. The diagnostic complex of plasma probing by heavy particle beams comprises heavy particle injector, detector unit with energy analyzer, the control system and the system for storage and processing of obtained experimental results. It is shown that time-of-flight method for determination of probing particle energy is the most promissing one for large facilities. DOE

N88-15679# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
STUDY ON THE MECHANICAL STRESSES IN THE ELEMENTS OF THE MODEL OF A TOROIDAL MAGNET OF A TOKAMAK WITH STRONG FIELD
N. A. Makhutov, N. I. Prigorovskij, A. V. Fomin, Yu. A. Alekseev, and V. V. Kisula 1986 21 p In RUSSIAN
(DE88-700343; IAE-4300/7) Avail: NTIS (US Sales Only) HC A03/MF A01

The results of studies on the mechanical stresses in the toroidal magnet model of a tokamak with strong field are considered. The results of experiments carried out by the brittle strain-sensitive coating method concerning the most stessed zone of the model design are presented. The results of design experiments aimed at determination of the stressed-deformed state inside the model on the basis of limited experimental data obtained in the zones accessible for installation of measuring equipment. DOE

N88-15680# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
CURRENT GENERATION AND INDUCED CONDUCTIVITY OF A PLASMA UNDER COMMON ACTION OF CONSTANT ELECTRIC FIELD AND LOWER-HYBRID OR ECR WAVES
Yu. N. Dnestrovskij, D. P. Kostomarov, V. V. Parail, and A. P. Smirnov 1986 8 p In RUSSIAN
(DE88-700345; IAE-4304/6) Avail: NTIS (US Sales Only) HC A02/MF A01

Analytical and numerical study was made on the effect of curl electric field on the efficiency of current generation by lower-hybrid and ECR-waves. The expression for induced plasma conductivity sigma/sub 1/ due to the group of epithermal electrons formed under the effect of high-frequency waves was obtained. Analytical formula for sigma/sub 1/ was derived for the low level high-frequency feed energy; for high power sigma/sub 1/ was determined on the base of numerical solution of two-dimensional kinetic equation. DOE

N88-15681# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
STUDY ON THE MODEL OF A TOROIDAL MAGNET FOR A TOKAMAK WITH A STRONG FIELD
A. M. Andrianov, Yu. A. Alekseev, and V. L. Baryshev 1986 32 p In RUSSIAN
(DE88-700346; IAE-4315/8) Avail: NTIS (US Sales Only) HC A03/MF A01

A study was made on the model of a toroidal magnet for a tokamak with strong field and combined adiabatic compression of plasma filament. Results of measuring basic electrotechnical parameters of the model, investigations of stress-strained state (SSS) of the most stressed central part of model structure (conducting turn and band) are presented. Results of testing basic structural materials of magnet coil-chromium and chromozirconium bronzes - are given as well. SSS model was studied with the use of methods for measuring mechanical stresses, based on application of brittle oxide and photoelastic coatings. It is shown that about 21 T fields can be achieved in the magnet. DOE

N88-15682# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
GAS FEED SYSTEM FOR THE T-15 TOKAMAK DISCHARGE CHAMBER
V. A. Gulyaev, B. S. Levkov, E. A. Maslennikov, G. E. Notkin, V. N. Polkanov, and V. M. Shchedrov 1986 16 p In RUSSIAN
(DE88-700351; IAE-4326/7) Avail: NTIS (US Sales Only) HC A03/MF A01

Hydrogen (deuterium) and rare gas feed system for the T-15 tokamak discharge chamber is described. Fast-response pulsed piezovalve designs used in the gas feed system are presented. Problems of automated gas feed control, depending on discharge chamber wall gas saturation, diaphragm and plasma parameters, are considered. DOE

N88-15683# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
SIMULATION AN EXPERIMENT ON PLASMA INSTABILITY INVESTIGATION IN A TOKAMAK WITH A DIVERTOR
N. A. Gasilov, S. N. Gerasimov, I. V. Zotov, and D. Yu. Sychugov 1986 24 p In RUSSIAN
(DE88-700352; IAE-4327/7) Avail: NTIS (US Sales Only) HC A03/MF A01

Results of calculating equilibrium of elongated plasma filament with two-zero and single-zero divertors are presented. Effect of external current location and vertical displacement of current channel center on separatrix splitting was analyzed. The data on properties of stabilizing systems composed of a random number of descrete ring conductors were obtained. Various conductor systems providing plasma stability under the assumption of their ideal conductivity were suggested for plasma filament with

parameters of T-12 tokamak. Increments of plasma instability occurring due to terminal conductivity of stabilizing elements were calculated. DOE

N88-15684# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
MODEL FOR PLASMA EQUILIBRIUM CONFIGURATION EVOLUTION IN A TOKAMAK WITH ADIABATIC COMPRESSION
V. E. Zhogolev 1986 16 p In RUSSIAN
(DE88-700354; IAE-4330/7) Avail: NTIS (US Sales Only) HC A03/MF A01

The problem statement of calculation of a series of plasma equilibrium configuration in the T-14, T-15 tokamaks related by conditions of flux frozen - in and the adiabatic law of pressure variation is given. The equations for the description of the internal equilibrium of a plasma which have a simpler form than for the electrodynamic momenta method and contain adiabatic couplings are obtained. The model suggested is convenient for construction of and algorithm aimed at calculation of parameter evoluation of a plasma with a free boundary during compression by an external field. The method for its realization is discussed and results of test calculations are given. DOE

N88-15685# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
RELATIVISTIC PLASMA CONCENTRATION MEASURING BY BREMSSTRAHLUNG
D. V. Gorozhanin and B. I. Ivanov 1986 4 p In RUSSIAN
(DE88-700560; KFTI-86-29) Avail: NTIS (US Sales Only) HC A02/MF A01

A method for measuring electron concentration (n sub e) in high-temperature plasma and in relativistic electron beams (REB) by integral electron bremsstrahlung on ions (neutrals) is suggested. Bremsstrahlung was measured by means of a scintillator from the volume filled with relativistic plasma generated in a mirror trap with an increasing magnetic field and representing rotating relativistic electrons charge-compensated by ions. A theoretical expression for effective bremsstrahlung cross section weakly depending on electron energy in the 10 sup 5-10 sup 6 eV range was used to determine n sub e. The results of measuring n sub e agree with data of other papers, where other methods have been applied for this purpose. The given method may be applied in facilities with the use of REB for controlled fusion as well as in Astron and Bampi torus type facilities and others. DOE

N88-15686# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
POSSIBILITY OF CALCULATION OF MAGNETIC SURFACE FUNCTION GRADIENT AND RELATED QUANTITIES
V. V. Nemov 1987 11 p In RUSSIAN
(DE88-700561; KFTI-87-2) Avail: NTIS (US Sales Only) HC A03/MF A01

A calculation method for gradient of magnetic surface functions nabla-PSI based on the solution of the standard linear differential equation system with variable coefficients is considered. The system described the behaviour of space derivatives of magnetic surface functions along the magnetic line of force. Computer-aided design of nablaPSI in torsatron magnetic fields as well as the examples of application of calculational results of nabla-PSI when calculating the standard to the magnetic surface component of drift rate of charged particles and equilibrium currents in the plasma with low gas-kinetic pressure are given. DOE

N88-15687# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
EXPERIMENTAL EVALUATION FOR EFFICIENCY OF EXCITATION SLOW PLASMA AND CYCLOTRON WAVES IN COLLECTIVE ACCELERATORS
B. I. Ivanov and D. V. Gorozhanin 1987 6 p In RUSSIAN
(DE88-700566; KFTI-87-7) Avail: NTIS (US Sales Only) HC A02/MF A01

Experiments on excitation of show cyclotron and plasma wawes (SCW, SPW) at electron beam excitation with the decelerating electro-dynamic system (a resonator with a spiral and a resonator with a space-periodic structure) in the external longitudinal homogeneous magnetic field are carried out to investigate methods of ion acceleration by charge density waves (CDW) of the electron beam. Efficiency of SCW and SPW excitation is determined and it is shown that it is detected by the fact, which accounts the relation of energy components of CDW between each other - active going to acceleration and HF-radiation, and reactive, stored in oscillating motion of beam particles - and decreases with the growth of CDW deceleration. Universality of multipliers of v/sub i//(v/sub e/-v/sub i/), v/sub p//(v/sub e/-v/sub p/), v/sub p//v/sub e/ type (where v/sub e/, v/sub i/ - electron and ion rates, v/sub p/ - phase rate of CDW) entering the expression of efficiency of ion acceleration by electron beams, is marked. DOE

N88-15688# Japan Atomic Energy Research Inst., Tokyo.
SIMPLE MODEL FOR HOT ION PLASMAS
P. R. Thomas May 1987 19 p
(DE88-750045; JAERI-M-87-064) Avail: NTIS (US Sales Only) HC A03/MF A01

This note describes a zero dimensional model for the power balance in the center of tokamaks with additional heating. The main features of the model are classical equipartition and characteristic times, based on L-mode scaling, to represent conductive and convective losses. The model has been tested against data from JET, JT-60 and TFTR. Satisfactory results are obtained if it is assumed that the ions are 3 - 5 times better confined than the electrons. The good performance of the TFTR supershots is found to be associated with the very high power density near to the magnetic axis which is characteristic of these discharges. JET and JT-60, having much lower power densities with NBI alone, can only match the TFTR ion temperatures at lower densities. The performance of JT-60 is predicted to improve markedly if deuterium is used instead of hydrogen. DOE

N88-15689# Japan Atomic Energy Research Inst., Tokyo.
MAIN PHYSICS FEATURES DRIVING DESIGN CONCEPT AND PHYSICS DESIGN CONSTRAINTS. CONCEPTUAL DESIGN STUDY OF FY86 FER
Noboru Fujisawa, Masayoshi Sugihara, and Shin Yamamoto Jul. 1987 67 p
(DE88-750309; JAERI-M-87-093) Avail: NTIS (US Sales Only) HC A04/MF A01

Major physics design philosophies are described, which are essential bases for a plasma design and may have significant impacts on a reactor design concept. Those design philosophies are classified into two groups, physics design drivers and physics design constraints. The design drivers are featured by the fact that a designer is free to choose and the choice may be guided by his opinion, such as ignition, a pulse length, an operation scenario, etc. The design constraints may follow a physical law, such as plasma confinement, Beta-limit, density limit, and so on. DOE

N88-15690# Los Alamos National Lab., N. Mex.
PHYSICS RATIONALE FOR THE ENGINEERING SPECIFICATIONS FOR ZTH
J. N. Dimarco 1987 34 p Presented at the International Workshop on Engineering Design of Next Step Reversed Field Pinch Devices, Los Alamos, N. Mex., 13 Jul. 1987
(Contract W-7405-eng-36)
(DE88-000938; CONF-8707105-2) Avail: NTIS HC A03/MF A01

This report presents the physics rationale that established the engineering design of ZTH. The physics criteria are given and the implications regarding the engineering design are presented. Experimental and theoretical background evidence is given in support of the criteria but the justification is left to other reports and peer reviews. The physics criteria discussed here are limited to the ones deemed to be of highest engineering priority. DOE

N88-15691# Oak Ridge National Lab., Tenn.
A CALORIMETER FOR MEASURING THE NEUTRAL BEAM POWER REACHING THE PLASMA
M. M. Menon, P. H. Edmonds, and C. L. Hahs 1987 3 p Presented at the 12th Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001412; CONF-871007-12) Avail: NTIS HC A02

A calorimeter has been designed to measure the neutral beam power reaching the Advanced Toroidal Facility (ATF) plasma. The high-heat-flux surface of this calorimeter is made of an array of graphite tiles. The calorimeter, which will be located in the adapter section between the ATF vacuum vessel and the beam line, is retractable so that it can be moved away from the plasma without opening the vacuum vessel during normal ATF operation. Two rows of thermocouples mounted perpendicular to each other allow determination of the beam profile. This paper presents the details of the design and fabrication of the calorimeter. DOE

N88-15692# Lawrence Livermore National Lab., Calif.
SUMMARY OF THE REPORT OF THE SENIOR COMMITTEE ON ENVIRONMENTAL, SAFETY AND ECONOMIC ASPECTS OF MAGNETIC FUSION ENERGY
J. P. Holdren, D. H. Berwald, R. J. Budnitz, J. G. Crocker, J. G. Delene, R. D. Endicott, M. S. Kazimi, R. A. Krakowski, B. G. Logan, and K. R. Schultz 10 Sep. 1987 105 p
(Contract W-7405-eng-48)
(DE88-003270; UCRL-53766-Summ) Avail: NTIS HC A06/MF A01

The Senior Committee on Environmental, Safety, and Economic Aspects of Magnetic Fusion Energy (ESECOM) has assessed magnetic fusion energy's prospects for providing energy with economic, environmental, and safety characteristics that would be attractive compared with other energy sources (mainly fission) available in the year 2015 and beyond. ESECOM gives particular attention to the interaction of environmental, safety, and economic characteristics of a variety of magnetic fusion reactors, and compares them with a variety of fission cases. Eight fusion cases, two fusion-fission hybrid cases, and four fission cases are examined, using consistent economic and safety models. These models permit exploration of the environmental, safety, and economic potential of fusion concepts using a wide range of possible materials choices, power densities, power conversion schemes, and fuel cycles. The ESECOM analysis indicates that magnetic fusion energy systems have the potential to achieve costs-of-electricity comparable to those of present and future fission systems, coupled with significant safety and environmental advantages. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N88-15693# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
ELECTRO-OPTICAL STUDIES OF SEMICONDUCTOR COMPOUNDS FOR ELECTROLUMINESCENT AND LASER DEVICES Ph.D. Thesis
Jukka A. Lahtinen 1986 54 p Sponsored by AT and T Bell Labs., the Finnish National Fund for Research and Development, and the Emil Aaltonen Foundation
(Ph-155; ISBN-951-666-239-0; ISSN-0355-2721; ETN-88-90732) Avail: NTIS HC A04/MF A01

Properties of the semiconductor compounds used in high field electroluminescence display devices and optical fiber communication lasers are discussed. The absorption edge of ZnS, InP, and InGaAsP as a function of growth conditions, doping, and composition, respectively, are studied by electroreflectance. It is shown that the growth temperature, reactant materials, and growth method contribute to the crystalline properties of the ZnS thin films. A method to determine the energy gaps from the overlapping electroreflectance line profiles is developed. The band population effects in InP are studied, and the composition dependence of four energy gaps in InGaAsP is described. The electrical and optical properties of InGaAsP/InP laser structures are characterized. Modifications in the construction of the double channel planar buried heterostructure laser improve temperature susceptibility. The V-groove distributed feedback laser is proved to be a remarkable dynamic single mode device. ESA

N88-15694# Oak Ridge National Lab., Tenn.
X-RAY MEASUREMENTS OF PHASON DISTORTION IN ION-IMPLANTED Al-Mn
J. D. Budai 1987 13 p Presented at the International Workshop on Quasicrystals, Beijing, China, 31 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE87-014566; CONF-8708154-1) Avail: NTIS HC A03/MF A01

An ion-implantation technique is described for producing thin layers of Al-Mn quasicrystal grains which are oriented over large areas (approx. sq cms). Exploiting this alignment, synchrotron X-ray diffraction measurements are obtained. The systematic distortions from perfect icosahedral symmetry are quantitatively explained in terms of a linear phason strain. The exact form of the phason strain for particular quasicrystal grains varies strongly with local growth conditions and appears to depend more directly on the interactions with the fcc matrix than with relaxations associated with the sample surface. DOE

N88-15695# Sandia National Labs., Albuquerque, N. Mex.
EFFECT OF THE BAND-GAP CHARACTERISTICS ON LASER-INDUCED DRY ETCHING OF SEMICONDUCTORS
C. I. H. Ashby and R. M. Biefeld 1987 12 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE88-001853; SAND-87-1144C; CONF-871027-38) Avail: NTIS HC A03/MF A01

The carrier-driven photochemical dry etching of both direct- and indirect-gap semiconductors depends strongly on the depth of generation of free carriers and the recombination behavior of those carriers. While excitation across the lowest energy gap, E sub 0, of a direct semiconductor produces many near-surface carriers to drive etching, too few carriers may be generated near the surface by excitation across E sub 0 of an indirect semiconductor for etching to occur. However, excitation across the direct E sub 1 gap of an indirect semiconductor produces sufficient near-surface carriers for rapid etching. Enhanced bulk carrier recombination in very heavily doped materials can suppress etching in both direct and indirect semiconductors. This paper studied GaAs(sub 1-x)P. DOE

N88-15696# Lawrence Livermore National Lab., Calif.
THERMAL STRESS ANALYSIS OF A COOLED MONOCHROMATOR CRYSTAL
G. L. Johnson, F. R. Holdener, and K. G. Tirsell 24 Nov. 1987 99 p
(Contract W-7405-eng-48)
(DE88-002116; UCID-21250) Avail: NTIS HC A05/MF A01

Wiggler X-ray monochromator designs must take full advantage of crystal geometric design, cooling method, and material properties to obtain peak performance. Objectives were: (1) to better understand the effect of beam power profile, crystal thickness, and crystal cooling scheme on crystal performance, and (2) to recommend an improved crystal cooling design. Five parameters were investigated: (1) cooling scheme (bottom-cooled vs side-cooled); (2) full surface cooling vs localized cooling; (3) crystal thickness (2 mm to 32 mm); (4) heat exchanger conductive interface material (silicone grease vs low-melting temperature metal); and (5) material property definition (constant vs temperature-dependent). Side cooling of thick crystals provided no major improvement in performance over bottom cooling. Crystal performance did not change

radically for thicknesses above 12 mm. The peformance of thin (less than 8 mm), bottom-cooled crystals was considerably dependent on the convective boundary conditions at the cooled surface. Also, a cooling design with a high conductivity metal as an interaface with the crystal improved performance for all thicknesses. DOE

N88-15697# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
GRAIN BOUNDARY AND SURFACE DIFFUSION IN OXIDES Progress Report, 15 Aug. 1986 - 1 Oct. 1987
V. S. Stubican 1 Oct. 1987 13 p
(Contract DE-FG02-85ER-45180)
(DE88-002348; DOE/ER-45180/T1) Avail: NTIS HC A03/MF A01

Diffusion of Co-57 in the surface layer of the (110) plane of single crystal NiO was studied. The Arrhenius plot for the surface diffusion shows no break in the temperature range 770 to 1200°C. An intrinsic vacancy mechanism is proposed. The first quantitative comparison between surface, grain boundary and volume diffusion for an ionic material was made. The surface diffusion coefficient for Co-57 is 1 to 2 orders of magnitude greater than the grain boundary diffusion coefficient and 5 to 7 orders of magnitude greater than the bulk coefficient. Activation energies for the surface, grain boundary and lattice diffusion of Co-57 in NiO are 139, 179 and 230 kJ/mole respectively. Study of the influence of point defects (vacancies and interstitials) on the surface diffusion is now in progress. Surface diffusion of Co-57 on the (110) plane of FeO and the (100) plane of NiO is being studied at 750°C under various oxygen pressures. Results obtained show the strong influence of cation vacancies on the surface diffusion in FeO. DOE

N88-15698# Sandia National Labs., Albuquerque, N. Mex.
CONTRAST BETWEEN THE CHEMICAL, STRUCTURAL AND ELECTRONIC PROPERTIES OF THIN FILMS OF Cu AND Ni ON THE Ru(0001) SURFACE
J. E. Houston, P. J. Berlowitz, J. M. White, and D. W. Goodman 1987 5 p Presented at the 34th National Vacuum Symposium and Topical Conference, Anaheim, Calif., 2 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002360; SAND-87-1308C; CONF-871125-11) Avail: NTIS HC A02/MF A01

Studies of the structural and electronic properties of thin Cu films on the Ru(0001) surface have revealed features which mirror the unique chemical behavior found for this bimetallic system. The interesting chemical behavior occurs in the submonolayer and ML regime where low-energy electron diffraction (LEED) studies showed that Cu adopts a pseudomorphic structure, implying that the overlayer is under a 6 percent strain. Photoemission studies have shown electronic properties for the pseudomorphic layer unlike those found for either bulk Ru(0001) or Cu(111). The Cu/Ru(0001) work was expanded to include a comparison with the Ni/Ru(0001) bimetallic system. The results of LEED, angle-resolved photoemission, thermal-programmed desorption and work-function measurements were compared. DOE

N88-15699# Sandia National Labs., Albuquerque, N. Mex.
FORMATION AND PASSIVATION OF NEW PARAMAGNETIC DEFECTS ASSOCIATED WITH THERMAL OXIDES ON SILICON
K. L. Brower 1987 4 p Presented at the Fall Meeting of the Materials Research Society, Boston, Mass., 30 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002720; SAND-87-1524C; CONF-871124-8) Avail: NTIS HC A02/MF A01

A new spin resonance spectrum has been observed with electron paramagnetic resonance in thermal oxides grown on (111) silicon. Our analysis indicates that this new spectrum consists of two isotropic resonances. One resonance has a g-value of 2.0026 and a linewidth (FWHM) of 1.2 G (labeled SL8); the other resonance has a g-value of 2.0029 and a linewidth (FWHM) of 5 G (labeled SL9). The SL8 resonance appears to be associated with the as-grown thermal oxide. The effects of Co-60 gamma irradiation and annealing in either hydrogen or ammonia on these spectra are also presented. DOE

N88-15700# Illinois Univ., Chicago.
LOW FIELD CHARACTERIZATION OF YBa2Cu3O SUB 7-DELTA SINGLE CRYSTALS
H. Claus, G. W. Crabtree, J. Z. Liu, W. K. Kwok, and A. Umezawa Oct. 1987 15 p Presented at the 32nd Conference on Magnetism and Magnetic Materials, Chicago, Ill., 9 Nov. 1987 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE88-002895; CONF-871126-7) Avail: NTIS HC A03/MF A01

Low field magnetization measurements in fields from zero to 100 Oe at temperatures from 4.2 to 100 K on single crystals of YBa2Cu3O7-delta are presented. The crystals have sharp inductive transitions at 91.5 K occasionally with additional structure suggesting a second phase with a lower T/sub c/. For all crystals in all directions the Meissner effect is a small fraction of the shielding effect. Low field measurements of H/sub c2/ within 1 K of T/sub c/ show a linear temperature dependence with a slope of 80 Oe/K, much smaller than observed at higher field. DOE

N88-15701# Argonne National Lab., Ill.
FABRICATION OF YBa2Cu3O7 SUPERCONDUCTING CERAMICS
R. B. Poeppel, B. K. Flandermeyer, J. T. Dusek, and I. D. Bloom Jun. 1987 6 p Presented at the 194th American Chemical Society National Meeting, New Orleans, La., 30 Aug. 1987
(Contract W-31-109-eng-38)
(DE88-003012; CONF-870802-29) Avail: NTIS HC A02/MF A01

Recent experience concerning the preparation of YBa2Cu3O7 powder and its fabrication into a variety of shapes is detailed. The fabrication techniques used were dry pressing, tape casting, and extrusion. Parameters found to affect superconductor quality are noted. DOE

N88-15702# Northwestern Univ., Evanston, Ill.
EMBEDDED CLUSTER MODELS FOR ELECTRONIC STRUCTURE AND ENERGETICS OF COMPLEX OXIDES
D. E. Ellis and D. J. Lam 1987 20 p Presented at the International Conference on Electronic Structure in Phase Stability in Advanced Ceramics, Argonne, Ill., 17 Aug. 1987 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE88-003097; CONF-870843-2) Avail: NTIS HC A03/MF A01

Electronic structures and energetics of complex oxide systems have been investigated using the self-consistent embedded cluster model in the framework of local density theory. Ground state charge and spin distributions and energy level diagrams are generated for perfect host lattices, and for vacancy and impurity environments. Polarization response of perfect and defected lattice is explored by performing self-consistent calculations in the presence of an external electric field. Local multipolar moments are determined for quantitative analysis of the response of the system to the induced disturbances. Cohesive energies are calculated for molecular fragments, and are used to study relative energetics of the perfect host lattices and various defect structures with and without external applied electric field. Results obtained from oxide systems with NaCl-type structure, as well as rare-earth and alkali-earth stabilized cubic zirconia and superconducting La2CuO4, are presented and discussed. DOE

N88-15703# California Univ., Berkeley. Lawrence Berkeley Lab.
ON THE COEXISTENCE OF PHONON AND NON-PHONON (PLASMON) MECHANISMS IN NEW HIGH T/SUB c/ SUPERCONDUCTORS
Vladimir Z. Kresin Jul. 1987 3 p Presented at the Adriatico Conference on High Temperature Superconductors, Trieste, Italy, 6 Jul. 1987
(Contract DE-AC03-76SF-00098)

(DE88-003188; LBL-24094; CONF-8707109-1) Avail: NTIS HC A02/MF A01

An analysis of recent experimental data shows that high T(sub c) is due to the coexistence of phonon and non-phonon mechanisms. DOE

N88-15704# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).

EVOLUTION OF RADIATION-INDUCED VOIDS AND DISLOCATIONS AT LOW TEMPERATURE

S. I. Turchin 1986 16 p In RUSSIAN

(DE88-700350; IAE-4325/11) Avail: NTIS (US Sales Only) HC A03/MF A01

Evolution of the set of vacancy loops (VL) generated in cascades of successive collisions of metal atoms (austenitic steels and alloys) during neutron and ion irradiation is studied analytically. It is shown that VL play the determining role in the development of radiation damage at a low temperature. Expression for the function of VL distribution over sizes is obtained, regularities of its development in time, taking into account other defects, are investigated. VL effect on swelling is determined. It is shown that the presence of low-temperature boundary of swelling and its displacement with the change in atom shift rate can be explained by the formation of VL sets. DOE

N88-15705# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.

GAMMA RADIATION AT THE 970 MeV PLANE POSITRON CHANNELING IN DIAMOND CRYSTALS

V. B. Ganenko, V. I. Noga, E. V. Pegushin, V. M. Sanin, and I. L. Semisalov 1986 5 p In RUSSIAN

(DE88-700557; KFTI-86-15) Avail: NTIS (US Sales Only) HC A02/MF A01

Measurements of gamma spectra of 970 MeV positrons during motion over the crystallographic plane (100) in 0.3 and 2 mm thick diamond monocrystals without gamma-quantum beam collimation and with weak collimation are conducted. Calculations of emission spectra satisfactorily describing experimental data and permitting to evaluate the ratio of channeling positrons; 25% for thin and 8% for thick diamond crystals are performed. Approximate estimation of postron dechanneling length of approx. 0.5 mm is obtained. DOE

N88-15706# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.

EFFECT OF IRRADIATION ON THE DIFFUSION EVOLUTION OF VOID ENSEMBLE IN CRYSTALS

V. I. Dubinko, P. N. Ostapchuk, and V. V. Slezov 1986 9 p In RUSSIAN

(DE88-700558; KFTI-86-16) Avail: NTIS (US Sales Only) HC A02/MF A01

Irradiation of crystals containing voids is shown to result in radiation coalescence: accelerated growth of voids with the radius exceeding the medium one at the expense of dissolving smaller voids. Tendency of voids to interstitial absorption inversely proportional to the radius of the voids is the main physical reason for distribution dimensions. The function of void distribution by their dimensions at high radiation doses is shown to aquire universal form independent from initial conditions. In this case the suggested theory is similar to the L-S theory of diffusion decomposition of oversaturated solid solutions but in contrast to the latter radiation intensity plays the role of temperature and the energy of void interaction with point defects appears as surface energy. The rate of radiation coalescence may be several orders higher than that of thermal coalescence. DOE

N88-15707# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.

CHANGE OF EUROPIUM CRYSTALLOGRAPHIC SYMMETRY AT HELICOIDAL MAGNETIC ORDERING

A. S. Bulatov and O. V. Kovalev 1986 12 p In RUSSIAN

(DE88-700559; KFTI-86-26) Avail: NTIS (US Sales Only) HC A03/MF A01

The effect of arising strong tetragonal tendency in europium bcc lattice at helicoidal magnetic ordering is stated experimentally. The group theory analysis discloses presence of exchange magnetoelastic invariants characteristic only for a spiral phase. A large number of them bring about noticeable crystal deformation over the helicoid axis. DOE

N88-15708# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.

WAVE FUNCTIONS FOR BOUND STATES OF RELATIVISTIC ELECTRONS IN A CRYSTAL AT ELECTRON MOVEMENT ALONG CRYSTALLOGRAPHIC PLANES

V. L. Morokhovskij 1987 6 p In RUSSIAN

(DE88-700563; KFTI-87-4) Avail: NTIS (US Sales Only) HC A02/MF A01

The algorithm for calculating wave functions of bound states of relativistic electrons in the crystal potential averaged along a crystallographic plane is described. Numerical calculations on BESM-6 computer of wave functions of electrons with 20 MeV energy moving in a diamond crystal along the plane (100) are given. DOE

N88-15709# California Univ., Berkeley. Lawrence Berkeley Lab.

NON-PHONON MECHANISMS OF SUPERCONDUCTIVITY IN HIGH T/SUB c/ SUPERCONDUCTING OXIDES AND OTHER MATERIALS AND THEIR MANIFESTATION

V. Z. Kresin Jun. 1987 15 p Presented at the Workshop on Novel Mechanisms for Superconductivity, Berkeley, Calif., 22 Jun. 1987

(Contract DE-AC03-76SF-00098)

(DE88-002708; LBL-24073; CONF-870682-6) Avail: NTIS HC A03/MF A01

Low dimensionality and the unusual parameter values in the high T(sub c) materials lead to a key contribution of the plasmon mechanism of superconductivity. In addition, these systems provide a unique opportunity to observe a multigap structure. The problem of the lattice instability is discussed. A manifestation of non-phonon mechanisms (NPM) in Nb3Ge and the contribution of the intramolecular vibrations are analyzed. Proximity systems containing high T(sub c) superconductors are promising from the point of view of possible applications. DOE

N88-15710# Rome Univ. (Italy). Dipartimento di Fisica.

LOCALIZATION OF Cu 3d LEVELS IN THE HIGH Tc SUPERCONDUCTOR YBa2Cu3O APPROXIMATELY 7 BY Cu2p X-RAY PHOTOELECTRON SPECTROSCOPY

A. Bianconi, A. CongiuCastellano, M. DeSantis, P. Delogu, A. Gargano, and R. Giorgi (Ente Nazionale per l'Energia Elettrica, Rome, Italy) 19 Jun. 1987 14 p Submitted for publication

(Nota-Interna-887; ETN-88-91248) Avail: NTIS HC A03/MF A01

The copper 2p(1/2) and 2p(3/2) X-ray photoelectron core level spectra (XPS) of the single phase high temperature (Tc=91 K) superconductor YBa2Cu3O approximately 7 were measured. Evidence for the strong localization of valence Cu 3d electrons is indicated by the Coulomb interaction U(cd)=9 eV between the 2p(3/2) core hole and the localized 3d valence electron. A Coulomb interaction U(dd) of the order of 6 eV between 3d valence electrons is estimated. No evidence of the 2p3d(8) final state due to the Cu(3+) ions is found. The broadening of atomic multiplets of the final state 2p3d(9) going from CuO to YBa2Cu3O approximately 7 is observed. The results are consistent with the formation of holes L in the oxygen derived band, i.e., of the 3d(9) L configuration, with additional oxygen x in YBa2Cu3O(6.5+x) which should play a key role in the high-Tc superconductivity. ESA

N88-15619*# Tennessee Technological Univ., Cookeville. Dept. of Mechanical Engineering.

A NUMERICAL STUDY OF TRANSIENT HEAT AND MASS TRANSFER IN CRYSTAL GROWTH

Samuel Bang-Moo Han *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship

Program Nov. 1987 29 p (For primary document see Summer Faculty Fellowship Program 29 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20L

N88-15627*# Florida Inst. of Tech., Melbourne. Dept. of Physics and Space Science.
IMPROVING THE METHOD OF CALCULATING ELECTRONIC PROPERTIES OF NARROW BANDGAP SEMICONDUCTORS
James D. Patterson *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 28 p (For primary document see Summer Faculty Fellowship Program 28 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N88-15711# Materials Research Labs., Ascot Vale (Australia).
THERMODYNAMIC VALUES FROM COMPUTER SUMMATION OF GROUP ADDITIVITY DATA
P. J. Sanders and R. K. Solly Mar. 1987 55 p
(AD-A186131; MRL-R-1066; AR-005-144) Avail: NTIS HC A04/MF A01 CSCL 07D

The second order approximation for the estimation of standard enthalpy of formation, entropy of formation and heat capacity of molecules by summation of atomic contributions with nearest neighbour interactions has been incorporated into a Fortran 77 computer program which currently executes on the IBM PC/XT and VAX 11/780 computers. The data base for the program also includes group corrections for next-to-nearest neighbor interactions and corrections for ring compounds.The program prompts for the required input, including the symmetry and optical isomers of the molecule, in an interactive manner and allows re-entry and correction of the data after input from computer terminal. GRA

N88-15712# Oak Ridge National Lab., Tenn.
EXCESS THERMODYNAMIC PROPERTIES OF AQUEOUS ELECTROLYTES TO HIGH TEMPERATURES AND PRESSURES
J. M. Simonson, H. F. Holmes, R. E. Mesmer, and R. H. Busey 1987 30 p Presented at the International Conference on Thermodynamics of Aqueous Systems with Industrial Applications, Warrenton, Va., 10 May 1987
(Contract DE-AC05-84OR-21400)
(DE88-001768; CONF-870594-3) Avail: NTIS HC A03/MF A01

Excess thermodynamic properties have been obtained for a number of pure and mixed aqueous electrolyte solutions at high temperatures and pressures through measurements of isopiestic ratios and enthalpies of dilution. The equipment and techniques used are described. Representations of the results used to correlate measured values and calculate other thermodynamic quantities are described. Isopiestic ratios relative to NaCl(aq) standard solutions have been measured for a number of classes of electrolytes to 250 C, including the alkali and alkaline earth chlorides, alkali sulfates and bisulfates, and a number of mixed electrolyte solutions. Flow calorimetric measurements of dilution enthalpies have been made as functions of temperature and pressure to 400 C and 400 bars on NaCl(aq), CaCl2(aq) and NaOH(aq). Results extend across the temperature range of transition between strong electrolyte behavior, as indicated by results at low temperatures, and ion association at high temperatures, as has been indicated in studies of electrical conductance. Modeling of the experimental results with other available data has given consistent sets of values of excess thermodynamic properties for a number of aqueous electrolyte systems. DOE

N88-15713# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
DETERMINATION OF THERMODYNAMIC FUNCTION OF MINERALS AT HIGH TEMPERATURES Final Report, 1 Jan. 1985 - 15 Apr. 1986
O. L. Anderson 15 Jul. 1987 53 p
(Contract DE-FG03-84ER-13203)
(DE88-001911; DOE/ER-13203/T1) Avail: NTIS HC A04/MF A01

It is proposed that the elastic constants of NaCl, KCl, corundum (Al2O3) and almadine garnet be measured. It is also proposed to use these new data and the corresponding existing data already measured for MgO, Mg2SiO4 and Fe2SiO4 to calculate the thermodynamic functions of these minerals into the high temperature range. The computations of the thermodynamic functions for MgO are completed, and those for Mg2SiO4 partially completed. Work was not yet begun on Fe2SiO4; instead the phase diagram of iron between 100 to 300 GPa and 3000 to 6000 K was targeted and worked out. The elastic constants of NaCl and KCl at high temperatures were measured, as well as the room-temperature elastic constants of corundum. The calculation of the thermodynamic functions for MgO are finished, and the calculations of the thermodynamic functions for Mg2SiO4 are partially finished. Calculations of the thermodynamic functions on NaCl are not yet begun. Some thermodynamic properties for Fe and the phase diagram of Fe up to Earth core pressures were calculated. DOE

N88-15714# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
DETERMINATION OF THERMODYNAMIC FUNCTION OF MINERALS AT HIGH TEMPERATURES Final Report, 1 Jan. 1985 - 15 Apr. 1986
O. L. Anderson 1986 52 p
(Contract DE-FG03-84ER-13203)
(DE88-002311; DOE/ER-13203/T2) Avail: NTIS HC A04/MF A01

The objective was to measure the elastic constants of several minerals and, where needed, the thermal expansivity of new minerals at high temperatures, using the Rectangular Parallelepiped Resonance (RPR) technique. The minerals of interest were NaCl, KCl, corundum (Al2O3), and almandine garnet. The elastic constants of NaCl and KCl were measured at high temperatures, and those of corundum at room temperature. The thermodynamic functions for MgO and Mg2SiO4 have been calculated. The phase diagram of iron has been calculated up to earth core pressures showing that the composition of the inner core of the earth is almost certainly iron in its epsilon (hcp) phase. DOE

N88-15715# Hungarian Academy of Sciences, Debrecen. Atommag Kutato Intezete.
SUPERSTRINGS ON QUANTUM SPACETIME
Zoltan Arvay 1987 13 p Submitted for publication
(DE88-700106; ATOMKI-A-20-1987) Avail: NTIS (US Sales Only) HC A03/MF A01

A lattice version of superstring theory was introduced by quantizing spacetime. As a natural choice the Planck length was set to be the fundamental length. In the framework of this model interesting new properties of strings were investigated which arise from the basic string mode cancellation. DOE

N88-15716# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
INSTANTON IN SUPERSYMMETRIC THEORY WITH STATIC DISORDER
V. S. Babichenko and A. N. Kozlov 1986 5 p
In RUSSIAN
(DE88-700357; IAE-4336/1) Avail: NTIS (US Sales Only) HC A02/MF A01

Quantum corrections for a tail of state density in the disordered chain are calculated. The semiclassical solution in the supersymmetry theory is obtained and integration by the zero modes of boson and fermion fields is made. DOE

N88-15717# Instituto de Fisica Teorica, Sao Paulo (Brazil).
PERTURBATIVE COHERENCE IN FIELD THEORY
R. Aldrovandi and R. A. Kraenkel 1987 18 p
(DE88-700366; IFT-P-21/87) Avail: NTIS (US Sales Only) HC A03/MF A01

A general condition for coherent quantization by perturbative methods is given, because the basic field equations of a fild theory are not always derivable from a Lagrangian. It's seen that non-lagrangian models way have well defined vertices, provided they satisfy what they call the coherence condition, which is less stringent than the condition for the existence of a Lagrangian. They note that Lagrangian theories are perturbatively coherent, in the sense that they have well defined vertices, and that they satisfy automatically that condition. DOE

N88-15718# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR).
MONTE CARLO SIMULATION OF TRIANGULATED RANDOM SURFACES IN GRAND CANONICAL ENSEMBLE
A. A. Migdal and V. V. Zmushko 1986 8 p
(DE88-700378; IFVE-OEF-86-90) Avail: NTIS (US Sales Only) HC A02/MF A01

The model of triangulated random surfaces, corresponding to discretization of Polyakov string model is considered. An algorithm is proposed, which makes it possible to study the model in grand canonical ensemble by the Monte Carlo method. Preliminary results for the critical index gamma are presented. DOE

N88-15719# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
OPERATOR FOUNDATION OF FUNCTIONAL INTEGRAL IN NON-ABELIAN GAUGE THEORY
NguenSuanKhan and V. N. Pervushin 1986 14 p In RUSSIAN; In RUSSIAN
(DE88-700508; JINR-R-2-86-645) Avail: NTIS (US Sales Only) HC A03/MF A01

A part integral is constructed which corresponds to a relativistically covariant schemes of canonical quantization of a non-Abelian theory. A special attention is paid to the problem of ordering of operators in the Hamiltonian and of the integral independence of the choice of gauge of integration variables. It is shown that the Weyl ordering of strengths corresponds to the relativistic covariance. Transition to the axial gauge and associated problems are considered. DOE

N88-15720# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
COMPUTERS IN THEORETICAL PHYSICS
V. P. Gerdt, M. G. Meshcheryakov, and D. V. Shirkov 1986 22 p In RUSSIAN; In RUSSIAN
(DE88-700516; JINR-R-2-86-848) Avail: NTIS (US Sales Only) HC A03/MF A01

The paper reviews the usage of computer mathematics in theoretical and mathematical investigations. Recommendations are given on further development of the JINR Computer Center in accordance with the program of theoretical researches. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N88-15721# Environmental Protection Agency, Corvallis, Oreg. Environmental Research Lab.
DESIGN AND MANAGEMENT OF RESEARCH PROJECTS
T. A. Murphy Sep. 1987 16 p
(PB88-106380; EPA/600/D-87/263) Avail: NTIS HC A03/MF A01 CSCL 05A

Design and management of research projects is a complex task which varies widely with the people and circumstances involved. An attempt is made to distill the literature and the author's personal experience into the basic elements of project management. Thus it is subjective and selective. It also is based largely on experience within the U.S. Since management is the art of influencing human behavior, it has a significant cultural component. Some of the principles described may differ significantly under other cultural or social conditions. Finally, the discussion deals primarily with applied research in a governmental or industrial research organization rather than the more basic research typically found in academia. Author

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N88-15722# Defense Technical Information Center, Alexandria, Va.
SOURCE HIERARCHY LIST. VOLUME 1: A THROUGH D Annual Report
Claudine S. Long Nov. 1987 697 p Supersedes DTIC/TR-86/17-Vol-1
(AD-A185900; DTIC/TR-87/18-Vol-1) Avail: NTIS HC A99/MF A02 CSCL 05B

This is the first of three volumes of an alphabetical listing of corporate authors as used for announcement of reports received in the Defense Technical Information Center (DTIC). Former names of organizations are included and displayed below the current source name used by DTIC. Cross references direct the user from sub-element organizations to the major source level entry where they are also displayed. This list is used in conjunction with and is not a replacement for DTIC's Source Header List, Volume 1, AD-A184 000, and Volume 2, AD-A184 001. It displays only those source names from the Source Header List which hierarchical linkages are pertinent. GRA

N88-15723# Defense Technical Information Center, Alexandria, Va.
SOURCE HIERARCHY LIST. VOLUME 2: E THROUGH O Annual Report
Claudine S. Long Nov. 1987 719 p Supersedes DTIC/TR-86/17-Vol-1
(AD-A185901; DTIC/TR-87/18-Vol-2) Avail: NTIS HC A99/MF A02 CSCL 05B

This is the second of three volumes of an alphabetical listing of corporate authors as used for announcement of reports received in the Defense Technical Information Center (DTIC). Former names of organizations are included and displayed below the current source name used by DTIC. Cross references direct the user from sub-element organizations to the major source level entry where they are displayed. This list is used in conjunction with and is not a replacement for DTIC's Source Header List, Volume 1, AD-A184 000, and Volume 2, AD-A 184 001. It displays only those source names from the Source Header List which hierarchical linkages are pertinent. GRA

N88-15724# Defense Technical Information Center, Alexandria, Va.
SOURCE HIERARCHY LIST. VOLUME 3: P THROUGH Z Annual Report
Claudine S. Long Nov. 1987 487 p
(AD-A185902; DTIC/TR-87/18-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 05B

This is the third of three volumes of an alphabetical listing of corporate authors as used for announcement of reports received in the Defense Technical Information Center (DTIC). Former names of organizations are included and displayed below the current source name used by DTIC. Cross references direct the user from sub-element organizations to the major source level entry where they are also displayed. This list is used in conjunction with and is not a replacement for DTIC's Source Header List, Volume 1, AD-A184 000, and Volume 2, AD-A184 001. It displays only those source names from the Source Header List which hierarchical linkages are pertinent. GRA

N88-15725# Defense Technical Information Center, Alexandria, Va. Office of Information Syst Ems and Technology.
DoD GATEWAY INFORMATION SYSTEM (DGIS) COMMON COMMAND LANGUAGE: THE FIRST PROTOTYPING AND THE DECISION FOR ARTIFICIAL INTELLIGENCE
Allan D. Kuhn, Randy L. Bixby, and Duc Tien Tran Aug. 1987 26 p
(AD-A185950; AD-F000114; DTIC/TR-87/19; DTIC-AI-FOUNDATION-SER-4) Avail: NTIS HC A03/MF A01 CSCL 05B

DoD gateway information system (DGIS) began its initial prototype in C language with DIALOG, BRS, NASA/RECON, and DROLS. These prototypes in a third-generation algorithmic language brought to the surface a number of problems and questions in dealing with the distinctions of information systems. The issues concern both the user interface and the development design. Experiences, results, and conclusions in working with these systems are brought out. The decision to convert to and continue CCL development with artificial intelligence tools is explained. Our effort is a merging of PROLOG and C capabilities, to provide the DGIS user an AI-based searcher assistant interface that makes the human-machine interaction more human-like on DGIS. GRA

N88-15726# Defense Technical Information Center, Alexandria, Va. Office of Information Systems and Technology.
DoD GATEWAY INFORMATION SYSTEM (DGIS): COMMON COMMAND LANGUAGE MAPPING
Randy L. Bixby Oct. 1987 22 p
(AD-A185951; AD-F000114; DTIC/TR-87/20; DTIC-CCL-2) Avail: NTIS HC A03/MF A01 CSCL 05B

The DoD Gateway Information System (DGIS) Common Command Language (CCL) project was initiated to provide a single standard command language for searching any online database system. This report relates the requirements analysis for the initial CCL prototypes in C language. Requirements were determined of six online database systems: DROLS, DIALOG, NASA/RECON, BRS, ORBIT, and MATRIS, using the National Information Standards Organization (NISO) draft standard for Common Command Language as a basis. Four C prototypes were completed: DROLS, DIALOG, BRS, and NASA/RECON. At that time the decision was made to incorporate artificial intelligence capabilities into CCL, and the programming of the CCL translators was converted to PROLOG. Author (GRA)

N88-15727# Naval Postgraduate School, Monterey, Calif.
A SUMMARY OF THE NAVAL POSTGRADUATE SCHOOL RESEARCH PROGRAM Summary Report, 1 Oct. 1985 - 30 Sep. 1986
30 Sep. 1987 412 p
(AD-A186362; NPS-012-87-002) Avail: NTIS HC A18/MF A01 CSCL 05B

This report contains 243 summaries of research projects which were carried out under funding to the Naval Postgraduate School Research Program. This research was conducted in the areas of Computer Science, Mathematics, Administrative Sciences, Operations Research, National Security Affairs, Physics, Electrical and Computer Engineering, Meteorology, Aeronautics, Oceanography, and Mechanical Engineering. The table of contents identifies specific research topics. GRA

N88-15728# Army Construction Engineering Research Lab., Champaign, Ill.
INDEX OF USA-CERL PUBLICATIONS FOR OCTOBER 1984 - JUNE 1987
Aug. 1987 91 p
(AD-A186375) Avail: NTIS HC A05/MF A01 CSCL 05B

This is an index to reports published by the U.S. Army Construction Engineering Research Laboratory from October 1984 through June 1987. It consists of a Report Number Index which lists complete bibliographic information on each report. There are also author, subject, title and AD number indexes; each of these indexes include the report number by which the user can refer to the Report Number Index to obtain the complete information of each report. GRA

N88-15729# Colorado Univ., Boulder. Dept. of Computer Science.
SELF-ADAPTIVE DATA BASES Annual Report, Sep. 1986 - Sep. 1987
Roger King 21 Sep. 1987 3 p
(Contract N00014-86-K-0054)
(AD-A186414; AD-E900710; CU-CS-153-7622) Avail: NTIS HC A02/MF A01 CSCL 05B

Over the past year, significant progress has been made, including the completion of a prototype database management system, and the publication of several papers. The central contribution of this system, called Cactis, is that it is the first database system to introduce elegant and efficient means for managing derived data. The goal of Cactis is to provide this support within the context of a self-adaptive database implementation. The project has also spawned a number of related efforts. The DBMS is being tested with a complex application, one that is of significant interest to the current research community - software environment technology. Other progress includes the development of a graphical interface to Cactis, one that maintains the philosophy of self-adaptiveness, by allowing the interface to adapt to the needs of a particular user. As an effort independent of Cactis, a system called Moby is under development. It is being coded in lisp, and is an experiment in extending database technology to include the one sort of derived data that Cactis cannot maintain - rule - based data. A final effort this year has been directed toward the support of complex constraints in the Cactis system. As many constraints may be represented as derived data, Cactis is a natural medium for this experimentation. This project is in cooperation with the Naval Ocean Systems Center in San Diego. GRA

N88-15730# General Accounting Office, Washington, D. C. Information Management and Technology Div.
NASA (NATIONAL AERONAUTICS AND SPACE ADMINISTRATION) ADP (AUTOMATED DATA PROCESSING) SYSTEM: INFORMATION ON THE AUTOMATED MISSION AND THE PAYLOAD TRACKING SYSTEM
Sep. 1987 12 p
(PB88-104989; GAO/IMTEC-87-38FS) Avail: NTIS HC A03/MF A01 CSCL 05B

The report contains information on the NASA Automated Mission and Payload Tracking System. The system is being developed to support the National Space Transportation System Program Office at the Lyndon B. Johnson Space Center. GRA

N88-15731*# Louisiana State Univ., Baton Rouge. Dept. of Computer Science.
INTERFACE BETWEEN ASTROPHYSICAL DATASETS AND DISTRIBUTED DATABASE MANAGEMENT SYSTEMS (DAVID) Progress Report
S. S. Iyengar Jan. 1988 11 p
(Grant NAG5-540)

(NASA-CR-182394; NAS 1.26:182394) Avail: NTIS HC A03/MF A01 CSCL 05B

This is a status report on the progress of the DAVID (Distributed Access View Integrated Database Management System) project being carried out at Louisiana State University, Baton Rouge, Louisiana. The objective is to implement an interface between Astrophysical datasets and DAVID. Discussed are design details and implementation specifics between DAVID and astrophysical datasets. Author

N88-15732* National Aeronautics and Space Administration, Washington, D.C.

NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS (SUPPLEMENT 32)

Jan. 1988 61 p

(NASA-SP-7039(32)-Sect-1-Abst; NAS 1.21:7039(32)-Sect-1-Abst) Avail: NTIS HC A04; NTIS standing order as PB 88-911100, $12.50 domestic, $25.00 foreign CSCL 05B

Abstracts are provided for 136 patents and patent applications entered into the NASA scientific and technical information system during the period July through December 1987. Each entry consists of a citation , an abstract, and in most cases, a key illustration selected from the patent or patent application. Author

N88-15605*# Alabama A & M Univ., Huntsville. Dept. of Mathematics.

COMPILATION AND DEVELOPMENT OF K-6 AEROSPACE MATERIALS FOR IMPLEMENTATION IN NASA SPACELINK ELECTRONIC INFORMATION SYSTEM

Jean A. Blake *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program 15 p (SEE N88-15601 07-70)

Avail: NTIS HC A99/MF E03 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N88-15733# Texas Univ., Austin. Center for Cybernetic Studies.

AN EXTENDED COBB-DOUGLAS FORM FOR USE IN PRODUCTION ECONOMICS

A. Charnes, W. W. Cooper, and A. P. Schinnar Dec. 1986 36 p

(Contract N00014-82-K-0295; Grants NSF SES-84-08134; NSF SES-85-20806)

(AD-A186372; CCS-555) Avail: NTIS HC A03/MF A01 CSCL 05C

The Cobb-Douglas function is widely used in production economics in the following form: A = AL sub alpha K sub beta, where alpha and beta along with A are positive constants that relate the inputs L (=Labor) and K (=Capital) to the amount of output Q. A variety of supposed alternatives and generalizations have been suggested in place of the Cobb-Douglas form for use in production economics. These alternatives and generalizations are here shown to be representable in an extended Cobb-Douglas form in which A, alpha and beta are functions of L and K rather than constants. This extension is then formally related to other general forms, such as the minimum discrimination information statistics, and used to explain the successful uses of the Cobb-Douglas function for the empirical applications in many different countries and contexts. GRA

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N88-15734 Deutsche Gesellschaft fuer Auswaertige Politik e.V., Bonn. Forschungsinst.

GERMAN SPACE POLICY ON THE THRESHOLD OF THE CENTURY. ANALYSIS AND PROPOSALS FOR THE FUTURE [DEUTSCHE WELTRAUMPOLITIK AN DER JAHRHUNDERT-SCHWELLE, ANALYSE AND VORSCHLAEGE FUER DIE ZUKUNFT]

1986 79 p In GERMAN

(ETN-88-90573) Copyright Avail: Issuing Activity

The importance of space research and space utilization in the framework of a global political concept of the Federal Republic of Germany is outlined. The economic, cultural, and social benefits, the improvement of public service, position and influence in international politics, security, and relations with Third World are discussed. ESA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

No abstracts in this category.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N88-15735 Stanford Univ., Calif.

AN ADIABATIC DEMAGNETIZATION COOLED BOLOMETER SYSTEM FOR MILLIMETER CONTINUUM ASTRONOMY Ph.D. Thesis

Lawrence Lesyna 1987 130 p

Avail: Univ. Microfilms Order No. DA8720411

An adiabatic demagnetization cooled bolometer system was constructed for the detection of astronomical one millimeter wavelength continuum radiation. By employing chromium potassium sulfate as a refrigeration agent, bolometers were cooled to temperatures below 0.1 Kelvin. The theory of both the refrigerator and detector operation is presented and is shown to strongly constrain a useful detector system. The measured performance of the refrigerator and bolometer are both found to be in good agreement with the theoretical predictions. The detector system was used at the Hale five meter telescope in November 1985. Using an unoptimized bolometer operating at a temperature of 0.2 Kelvin, a demonstration of the sensitive detection of astronomical one millimeter radiation was made. Preliminary results

suggest that adiabatic demagnetization is a practical method for cooling bolometers used in astronomical applications. Spacecraft adaptation of this system is briefly discussed. One millimeter continuum observations of Cynus A made with a pumped helium-three refrigerator detector system are presented. The major components of the radio galaxy were detected, and are interpreted in the context of a beam model for radio emission. The one millimeter observations are consistent with power law distributions of relativistic electrons emitting synchrotron radiation.
Dissert. Abstr.

N88-15736# Helsinki Univ. of Technology, Espoo (Finland). Radio lab.
FINNISH-SOVIET SYMPOSIUM ON RADIO ASTRONOMY (1ST) HELD AT OTANLEMI ON AUGUST 26-27, 1985
S. Urpo 1986 66 p Symposium held in Otanlemi, Finland, 26-27 Aug. 1985
(PB87-140661; S-166; ISBN-951-753-762-X) Avail: NTIS HC E04/MF E01 CSCL 03A

Topics discussed include, in part: (1) solar and stellar dynamos; (2) cyclic behavior of solar rotation; (3) millimeter solar research at the Metsahovi Radio Research Station; (4) results of the solar radio emission investigations in SIBIZMIR; (5) redshift asymmetries in systems of galaxies and the missing mass; (6) quasar research at Metsahovi; and (7) high velocity flows and Herbig-Haro objects.
GRA

N88-15737# Yunnan Univ., Kunming (China).
OBSERVATIONS OF THE SOLAR CHROMOSPHERE IN KUNMING
Y. Zhou and Q. Li 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143319; ISTIC-TR-C-000021) Avail: NTIS HC E03/MF E01 CSCL 03A

The paper gives an account of the process of the solar total eclipse of February 16, 1980 in the chromospheric layers observed in Kunming, China. It also provides the moments of occultations of various active objects (including sunspots, flocculi, filaments and prominences) by the shadow of the moon. They are important clues for the analyses of radio-astronomical, ionospheric, and various optical observations of the solar eclipse.
GRA

N88-15738*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CATALOG OF INFRARED OBSERVATIONS. PART 1: DATA Second Edition
Daniel Y. Gezari, Marion Schmitz (Computer Sciences Corp., Beltsville, Md.), and Jaylee M. Mead Dec. 1987 625 p
(NASA-RP-1196-Pt-1-Ed-2; NAS 1.61:1196-Pt-1-Ed-2) Avail: NTIS HC A99/MF A01 CSCL 03A

The Catalog of Infrared Observations (CIO) is a compilation of infrared astronomical observational data obtained from an extensive literature search of astronomical journals and major astronomical catalogs and surveys. The literature searches are complete for 1965 through 1986 in this Second Edition. The Catalog is published in two parts, with the observational data (roughly 200,000 observations of 20,000 individual sources) listed in Part I, and supporting appendices in Part II. The expanded Second Edition contains a new feature: complete IRAS 4-band data for all CIO sources detected, listed with the main Catalog observations, as well as in complete detail in the Appendix. The appendices include an atlas of infrared source positions, two bibliographies of infrared literature upon which the search was based, and, keyed to the main Catalog listings (organized alphabetically by author and then chronologically), an atlas of infrared spectral ranges, and IRAS data from the CIO sources. The complete CIO database is available to qualified users in printed microfiche and magnetic tape formats.
Author

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N88-15739# Geneva Observatory (Switzerland).
MEMBERSHIP OF CEPHEIDS AND RED GIANTS IN 8 OPEN CLUSTERS: NGC 129, 6067, 6649, 6664, IC 4725, LY 6, RU 79
J. C. Mermilliod (Lausanne Univ., Switzerland), M. Mayor, and G. Burki 1987 26 p Submitted for publication Sponsored by the Swiss National Fund for Scientific Research
(Publ-Ser-C-Fasc-13; ETN-88-91107) Avail: NTIS HC A03/MF A01

The membership of 8 cluster Cepheids, DL Cas, Ev Sct, V367 Set, S Nor, TW Nor, V340 Nor, USgr and CS Vel, were examined by comparing their systemic radial velocity with that observed for the red giants in the same clusters. The membership is very probable in seven cases, the exception being CS Vel. Additional observations of main sequence stars are necessary to confirm conclusions. One spectroscopic binary was discovered among the Cepheids (DL Cas) and at least four were among the red giants. Orbits for two red giants, in NGC 129 and IC 4725 were determined. The position within the instability strip of the nonvariable F5Ib star in NGC 129 is due to its probable composite (gK+dB) character. The ratio of the number of Cepheids to the number of red giants is less than 1, in good agreement with the prediction of evolutionary models with core overshooting.
ESA

N88-15740# Geneva Observatory (Switzerland).
COLOR-MAGNITUDE DIAGRAMS OF STAR CLUSTERS IN THE MAGELLANIC CLOUDS FROM WIDE-FIELD ELECTRONOGRAPHY. PART 3: NGC 1841
J. Andersen, A. Blecha, and Merle F. Walker (Lick Observatory, Santa Cruz, Calif.) 1987 14 p Submitted for publication Sponsored by the Danish Board for the Astronomical Research, and the Carlsberg Foundation
(Grants NSF AST-80-18187; RG-244-81)
(Publ-Ser-C-Fasc-14; ETN-88-91108) Avail: NTIS HC A03/MF A01

The color-magnitude diagram (CMD) of NGC 1841, an outlying globular cluster in the Magellanic System, was constructed from electronographic photometry of 390 stars in the annular field R between 22 and 72', to a limit of V = 22.5. The detailed CMD confirms classifications of NGC 1841 as belonging to the oldest and most metal-poor population of the Magellanic System. For an adopted reddening of E (B-V) = 0.15, the CMD of NGC 1841 closely matches that of the galactic globular cluster M 92, indicating that the clusters are of similar age and metal abundance. The fit of the 2 CMDs yields a distance modulus to NGC 1841 of (m-M)o = 18.1 + or - 0.3. This places NGC 1841 within the disk system formed by the other old LMC clusters 10 kpc from the center of the LMC itself, in contrast to earlier results placing it well beyond the LMC. It also eliminates the discrepancy between the luminosities of its giant stars and similar Galactic globular cluster giants.
ESA

N88-15741# Fundacio Empresa i Ciencia, Barcelona (Spain).
STUDY ON ORBITS NEAR THE TRIANGULAR LIBRATION POINTS IN THE PERTURBED RESTRICTED THREE BODY PROBLEM Final Report
G. Gomez, J. Llibre, R. Martinez, and C. Simo (Barcelona Univ., Spain) Paris, France ESA Feb. 1987 239 p
(Contract ESOC-6139/84-D-JS(SC))
(ESA-CR(P)-2440; ETN-88-91137) Avail: NTIS HC A11/MF A01

Periodic orbits of the bicircular problem and their stability; numerical simulations of the motion in an extended neighborhood of the triangular libration points in the Earth-Moon system; the equations of motion; periodic orbits of intermediate equations; a semianalytical approach to the quasi-periodic solution of the global equations; numerical determination of suitable orbits of the simplified system; and relative motion of two close spacecraft are discussed. There is evidence that orbits moving in a large annulus

around L4 and L5 exist, that these orbits have small components out of the plane of the Earth-Moon system, and that they are at most mildly unstable. ESA

N88-15742# Los Alamos National Lab., N. Mex.
AGB (ASYMPTOTIC GIANT BRANCH): STAR EVOLUTION
S. A. Becker 1987 12 p Presented at the Symposium on the Origin and Distribution of Elements, New Orleans, La., 31 Aug. 1987
(Contract W-7405-eng-36)
(DE88-001829; LA-UR-87-3448; CONF-8708165-1) Avail: NTIS HC A03/MF A01

Asymptotic giant branch stars are red supergiant stars of low-to-intermediate mass. This class of stars is of particular interest because many of them can have nuclear processed material brought up repeatedly from the deep interior to the surface where it can be observed. A review of recent theoretical and observational work on stars undergoing the asymptotic giant branch phase is presented. DOE

N88-15743# Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics.
NUMBER COUNT-REDSHIFT RELATION IN A PERTURBED FRIEDMANN UNIVERSE
Masumi Kasai and Misao Sasaki Jun. 1987 11 p
(DE88-750302; RRK-87-8) Avail: NTIS (US Sales Only) HC A03/MF A01

The number count-redshift relation in a linearly perturbed Friedmann universe is derived. It is shown that the resulting formula is invariant under any coordinate-gauge transformation and any affine parameter rescaling. Then it is applied to a perturbed Einstein-de Sitter model. DOE

N88-15744# Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics.
POST-NEWTONIAN EQUATIONS OF MOTION IN AN EXPANDING UNIVERSE
Kenji Tomita Jun. 1987 9 p
(DE88-750303; RRK-87-12) Avail: NTIS (US Sales Only) HC A02/MF A01

Equations of motion are derived in the post-Newtonian approximation in an expanding universe and their invariant property is examined. DOE

N88-15745# Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics.
EVOLUTION FROM PURE STATES INTO MIXED STATES IN DE SITTER SPACE
Masa-aki Sakagami Mar. 1987 24 p
(DE88-750316; RRK-87-5) Avail: NTIS (US Sales Only) HC A03/MF A01

An attempt is made to clarify realization of a classical distribution from quantum fluctuations of the order parameter in the inflationary universe. We discuss destruction of quantum coherence associated with a state of the order parameter in models where it interacts with the environment. For that purpose, the time evolution of the reduced density matrix rho tilde, which is obtained by coarse-graining of the environment, is investigated. It is shown that off-diagonal elements of rho tilde decrease as the phase transition proceeds. DOE

N88-15746*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Goddard Space Flight Center.
NUMERICAL MODELLING OF THE CLASSICAL NOVA OUTBURST
G. S. Kutter and W. M. Sparks 1987 3 p Presented at the IAU Colloquium No. 108, Tokyo, Japan, 1 Sep. 1987 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(NASA-TM-89707; NAS 1.15:89707; DE88-001843; LA-UR-87-3356; CONF-8709186-1) Avail: NTIS HC A02/MF A01 CSCL 03B

A mechanism is described that promises to explain how nova outbursts take place on white dwarf of 1 solar mass or less and for accretion rates of 4 x 10 to the -10 solar mass/yr or greater. DOE

N88-15611*# Alabama Univ., Huntsville. Dept. of Physics and Astronomy.
INFRARED EMISSION AND TIDAL INTERACTIONS OF SPIRAL GALAXIES
Gene G. Byrd *In* NASA. Marshall Space Flight Center, Research Reports: 1987 NASA/ASEE Summer Faculty Fellowship Program Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program 19 p (SEE N88-15601 07-70)
Avail: NTIS HC A99/MF E03 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N88-15747# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PARTICLE-GAS TEMPERATURE DIFFERENTIALS RESULTING FROM TIME-DEPENDENT RADIATIVE-CONDUCTIVE HEAT FLUX DIVERGENCES IN THE TENUOUS DUST-LADEN ATMOSPHERE OF MARS M.S. Thesis
Paul J. Bellaire, Jr. 1987 207 p
(AD-A185888; AFIT/CI/NR-87-47T) Avail: NTIS HC A10/MF A01 CSCL 03B

For an aerosol atmosphere, disparities in gas temperature, sub g, and particle temperature, sub g, may arise over the diurnal cycle. A radiative-conductive- convective heat transfer simulation of the dusty atmosphere of Mars was developed to quantify the temporal and spatial character of the temperature difference (sub p - sub g). This program computed thermal energy fluxes in the temporal and vertical domains in a 51-layer, vertically inhomogeneous , plane-parallel model atmosphere, with a 30 layer simulated ground structure. Observations from Mariner and Viking spacecraft were used in conjunction with other research findings to provide model input and set the boundary and initial conditions for the simulation. Temperature fields within the atmosphere were inferred from radiative-conductive-convective flux fields by means of enthalpy rate principles, while the radiation laws of Kirchoff and Planck were applied to the flux fields to determine aerosol temperatures. Several independent methods of validation were sucessfully applied to the model output, including comparisons with distinct spacecraft observations and the separate computation of dust heating effects outside the model. GRA

N88-15748# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data and Information Service.
ESTIMATION OF BROADBAND PLANETARY ALBEDO FROM OPERATIONAL NARROWBAND SATELLITE MEASUREMENTS
J. E. Wydick, P. A. Davis, and A. Gruber Apr. 1987 42 p Prepared in cooperation with Research and Data Systems, Inc., Lanham, Md.
(PB88-107644; NOAA-TR-NESDIS-27) Avail: NTIS HC A03/MF A01 CSCL 03B

A scene independent algorithm for estimating broadband planetary (top-of-atmosphere) albedo using NOAA/AVHRR narrowband satellite data is presented. Initial results from a radiative transfer model investigation are given, followed by empirical coefficients that are deduced through multivariant regression analysis of Nimbus-7/ERB broadband data and NOAA-7/AVHRR narrowband data. Planetary schemes are grouped into five major catagories. Strong variations in the two channel AVHRR narrowband albedo observations are noted for different scene classifications which emphasize the potential error in using a single AVHRR channel 1 (0.58 to 0.68 micrometer) albedo determination

as has historically been done. The results presented should allow improved albedo calculations when one is limited to AVHRR narrowband data. Author

N88-15749# Bonn Univ. (West Germany). Inst. fuer Physik.
A REFRACTOMETER FOR THE INTERFEROMETRIC DETERMINATION OF THE HELIUM ABUNDANCE IN THE JUPITER ATMOSPHERE Ph.D. Thesis [EIN REFRAKTOMETER ZUR INTERFEROMETRISCHEN BESTIMMUNG DER HELIUM-HAEUFIKEIT IN DER JUPITERATMOSPHAERE]
Horst Schuetze Jul. 1986 77 p In GERMAN Sponsored by Bundesministerium fuer Forschung und Technologie
(Bonn-IR-86-23; ISSN-0172-8741; ETN-88-90797) Avail: NTIS HC A05/MF A01

It is demonstrated that an interferometer can measure the abundance of helium in the Jupiter atmosphere. The accuracy of the determinations is proved by hundreds of simulations in an artificial Jupiter atmosphere. For eliminating other gases, an appropriate absorber was found and its influence on the helium determinations was analyzed. The corresponding correcting function was used for computing the measured data with an incorporated absorber. The helium content of the very accurately prepared gas mixtures, with or without an addition of other gases, was determined with a precision of + or - 0.1 percent. ESA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation*.

N88-15750# Chemical Research and Development Center, Aberdeen Proving Ground, Md.
THE USE OF THE DIRECT MEASUREMENT OF SOLAR RADIATION FOR THE DETERMINATION OF PASQUILL STABILITY PARAMETER Technical Report, Jan. - Aug. 1984
Michael M. Myirski Jul. 1987 37 p
(AD-A186084; CRDEC-TR-87065) Avail: NTIS HC A03/MF A01 CSCL 03B

Two schemes for estimating the amount of solar radiation received at the Earth's surface are compared to solar radiation measurements. This data was acquired over a total of 25 days and from 214 individual observations. These observations were grouped into both instantaneous and hourly averaged data. Of the two schemes studied, the insolation parameter Psi performed better than the net radiation index used in the Pasquill-Turner Stability Category algorithm. To eliminate the need to subjectively estimate the amount of solar radiation, an algorithm is presented to determine a continuous Pasquill Stability Parameter based on direct measurement of solar radiation. This algorithm compares favorably to one previously developed by Great Britain's meteorological office. GRA

N88-15751# Arizona Univ., Tucson.
PERTURBATIONS OF THE SUN'S GRAVITATIONAL FIELD DUE TO SOLAR OSCILLATIONS
H. A. Hill 20 Oct. 1987 6 p Presented at the International Symposium on Experimental Gravitational Physics, Guangzhou, China, 3 Aug. 1987
(Contract DE-FG02-87ER-13670)
(DE88-002099; CONF-8708168-1) Avail: NTIS HC A02/MF A01

Considerable evidence has been presented for the detection of low-degree internal gravity modes of the Sun. By combining the observations obtained at the Crimean Astrophysical Observatory and at SCLERA, a number of the modes have been classified with respect to their spatial properties. The number of such classifications has been extended in a subsequent gravity-mode project by Gu and Hill. These mode classifications have been tested using three additional sets of independent observations. Positive results have been obtained. These low-degree modes lead to oscillatory perturbations of the Sun's gravitational field. The amplitudes of these perturbations at the Earth are inferred from the observed temperature eigenfunctions. For the l = 2 modes with frequencies near 100 microHerz, it is projected that these perturbations in the gravitational field will produce strains of the order of 1.0E-18 in gravitational radiation detectors based on free masses. The signals are expected to have coherence times of hundreds or more years. The detection of these signals by gravitational radiation detectors would make available a new technique for use in solar seismological studies which could be quite useful. The detection of these signals could also serve as a way of monitoring the performance of a given set of gravitational radiation detectors. DOE

N88-15752# Arizona Univ., Tucson.
SOLAR OSCILLATIONS, GRAVITATIONAL MULTIPOLE FIELD OF THE SUN AND THE SOLAR NEUTRINO PARADOX
H. A. Hill and R. D. Rosenwald Nov. 1986 37 p Presented at the NATO Advanced Workshop on Mathematical Aspects of Gravity and Supergravity, Logan, Utah, 21 Jul. 1986
(Contract DE-FG02-87ER-13670)
(DE88-002100; CONF-8607349-1) Avail: NTIS HC A03/MF A01

The visual solar oblateness work and the solar seismological work on the internal rotation of the Sun are reviewed and their implications concerning the static gravitational multipole moments of the Sun discussed. The results of this work are quite deviant which is indicative of the complexity encountered and of the necessity for continued studies based on a diverse set of observing techniques. The evidence for phase-locked internal gravity modes of the Sun is reviewed and the implications for the solar neutrino paradox are discussed. The rather unique possibility for testing the relevance which the phase-locked gravity modes have to this paradox is also noted. The oscillating perturbations in the Sun's gravitational field produced by the classified internal gravity modes and the phase-locked modes are inferred from the observed temperature eigenfunctions. Strains of the order of 10 to the -18 power in gravitational radiation detectors based on free masses are inferred for frequencies near 100 microHerz. The relevance of these findings is discussed in terms of a new technique for use in solar seismological studies and of producing background signals in studies of low-frequency gravitational radiation. DOE

N88-15753# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
SHORT-TERM TEMPORAL VARIATIONS OF NIMBUS-7 MEASUREMENTS OF THE SOLAR UV SPECTRAL IRRADIANCE
R. E. Donnelly, D. E. Stevens, J. Barrett, and K. Pfendt Jun. 1987 64 p
(PB88-102132; NOAA-TM-ERL-ARL-154) Avail: NTIS HC A04/MF A01 CSCL 03B

NIMBUS-7 measurements of the solar spectral irradiance in the 160 to 400 nm range during Nov. 7, 1978 to Oct. 29, 1984 were analyzed to determine the characteristics of their short term variations. The persistance of solar-rotational variations is shown to be uniformly high for the UV wavelengths important for inducing stratospheric photochemical reactions and for heating the stratosphere, which contrasts greatly with the low and nonuniform persistence for coronal EUV wavelengths and the standard ground based measures of solar variability, the Ottawa 10.7 cm flux (F10) and sunspot number (R). Periodicity in the 13 to 14 day range is the second strongest short term variation (27 to 28 day solar rotational variations are the strongest short term periodicity). The ratios of power in the 13 day periodicity to that in the 27 day periodicity is fairly constant for photospheric UV fluxes throughout the 170 to 260 nm wavelength range, the main exception being the chromospheric Si II lines in the 180 to 182 nm range. Author

N88-15754# Beijing Normal Univ. (China).
TOTAL LIGHT FLUX AND COLOUR OF SOLAR CORONA
Y. Hao 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing

(PB87-143335; ISTIC-TR-C-000023) Avail: NTIS HC E03/MF E01 CSCL 03B

Measurements were made of the light flux and color of the corona in 1.03-6.0 solar radii with a multiple-band electrophotometer. The effective wavelengths of the instrument are 450, 555, 650 and 940. In one of them, the 555 band, the spectral rresponse defines a system that is in close agreement with the spectral response of the human eye. The results of the measurements are as follows: (1) the total light flux of the corona Lc is equal to 1.23 times 10 to the minus 7th power L(Solar); (2) in 555, 650 and 940 bands, there is no color difference between the corona and the photosphere. GRA

N88-15755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ENERGETICS AND DYNAMICS OF SIMPLE IMPULSIVE SOLAR FLARES

R. Starr, W. A. Heindl, C. J. Crannell, R. J. Thomas, D. A. Batchelor, and A. Magun Dec. 1987 53 p

(NASA-TM-87816; NAS 1.15:87816) Avail: NTIS HC A04/MF A01 CSCL 03B

Flare energetics and dynamics were studied using observations of simple impulsive spike bursts. A large, homogeneous set of events was selected to enable the most definite tests possible of competing flare models, in the absence of spatially resolved observations. The emission mechanisms and specific flare models that were considered in this investigation are described, and the derivations of the parameters that were tested are presented. Results of the correlation analysis between soft and hard X-ray energetics are also presented. The ion conduction front model and tests of that model with the well-observed spike bursts are described. Finally, conclusions drawn from this investigation and suggestions for future studies are discussed. B.G.

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

N88-15756 California Univ., San Diego.

HEAO-1 OBSERVATIONS OF GAMMA-RAY BURSTS Ph.D. Thesis

Geoffrey James Hueter 1987 318 p

Avail: Microfilms Order No. DA8720172

The Hard X-Ray and low Energy Gamma Ray Experiment on the First High Energy Astronomical Observatory (HEAO-1), which operated from August, 1977 to January, 1979, detected 21 bursts above a limiting fluence sensitivity of 2 x 10 to the minus 7th ergs/sq cm. The measurement of spectral features confirms the neutron star origin for gamma-ray bursts. Limits on the source conditions derived from the line and continuum observations lead a description of burst emission near the surface of the star, while the higher energy emission, arises from pair annihilation outside the magnetosphere. After correctly modeling burst selection effects, the data showed no evidence for a deviation from uniformity in the distributions of burst fluence and positions. Dissert. Abstr.

N88-15596# Joint Publications Research Service, Arlington, Va.

MULTIPLY CHARGED PARTICLES IN PRIMARY COSMIC RAYS WITH ENERGY LESS THAN OR EQUAL TO 2 TeV Abstract Only

I. P. Ivanenko, N. L. Grigorov, V. Ya. Shestoperov, Yu. V. Basina, P. V. Vakulov, Yu. Ya. Vasilyev, R. M. Golynskaya, L. B. Grigoryeva, D. A. Zhuravlev, and V. I. Zatsepin et al. *In its* USSR Report: Physics and Mathematics 12 Mar. 1987 p 66-67 Transl. into ENGLISH from Pisma v Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki (Moscow, USSR), v. 44, no. 4, 25 Aug. 1986 p 200-202 Previously announced in IAA as A87-29683 (For primary document see N88-15575 07-70)

Avail: NTIS HC A05/MF A01

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99 GENERAL

No abstracts in this category.

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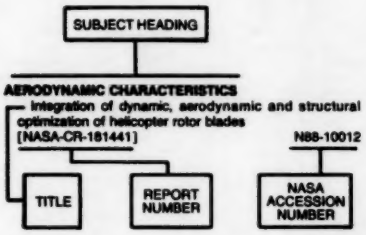

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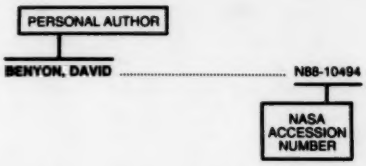

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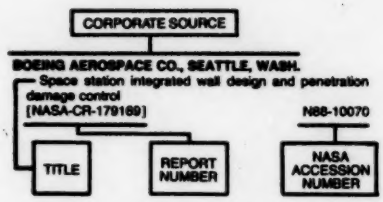

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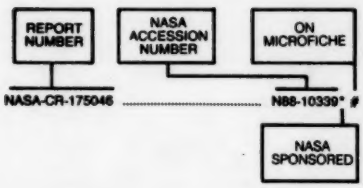

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